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SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

New York City: Grand Central Terminal

Lancaster, Pa. Garrison, N. Y.

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

PRELIMINARY ANNOUNCEMENT OF THE VIRGINIA MEETING

Edited by Dr. F. R. MOULTON

PERMANENT SECRETARY

FROM December 27 to 31, 1938, the association and about 35 of its affiliated societies will hold meetings in Richmond, Virginia. This is the one hundred third meeting of the association.

Richmond, the capital of Virginia, is a city of approximately 200,000 inhabitants. Not only is it a city of proud traditions, culture and education, but it is a center of industry and finance, being the seat of the Federal Reserve Bank of the Fifth District. Near its center is the Medical College of Virginia, a vigorous and rapidly expanding institution which last spring celebrated the one hundredth anniversary of its founding. In a suburb are the colleges for men and for women of the University of Richmond, and the College of William and Mary has a Richmond division. In addition, there are in this city a law school, a theological seminary and a university for colored students.

REGISTRATION

Registration will be in the Mosque, a magnificent recently constructed building within easy reach of all the hotels in Richmond and of each of the four groups of meeting rooms in which the scientific sessions will be held. The Mosque has splendidly appointed lounges, several rooms in which conferences and committees may meet and a restaurant which will be in operation during the meeting. The presidential address and the addresses delivered under the auspices of the Society of the Sigma Xi and the United Chapters of Phi Beta Kappa, as well as several other gen-

eral addresses, will be delivered in the fine auditorium of the Mosque, which seats 4,500 persons. Moreover, the annual science exhibition of the association will be in the Mosque.

HOTELS AND HEADQUARTERS

General Headquarters: Jefferson Hotel.

Headquarters of the sections of the association and of the affiliated societies meeting in Richmond are as follows:

Jefferson Hotel: Sections on Geology and Geography (E), Botanical Sciences (G), Psychology (I), Social and Economic Sciences (K), Historical and Philological Sciences (L), Medical Sciences (N) and Subsection on Pharmacy, Agriculture (O), Education (Q), Botanical Society of America, American Phytopathological Society, American Society of Plant Physiologists, Mycological Society of America, American Fern Society, Sullivant Moss Society, American Society of Agronomy, American Society for Horticultural Science, Potato Association of America, American Psychiatric Association, Society of the Sigma Xi, United Chapters of Phi Beta Kappa, Sigma Delta Epsilon Graduate Women's Fraternity and National Social Science Honor Society Pi Gamma Mu.

John Marshall Hotel: Sections on Astronomy (D) and Anthropology (H), Society for Research on Meteorites, American Meteorological Society, American Association of Economic Entomologists, Entomological Society of America, American Nature Study Society, American Science Teachers Association and Gamma Alpha Graduate Scientific Fraternity.

Murphy Hotel: Section on Engineering (M), Ecological Society of America, Genetics Society of America, Limnological Society of America and Metric Association.

Richmond Hotel: Sections on Chemistry (C) and Subsection on Dentistry of the Section on Medical Sciences (N), Zoological Sciences (F), American Society of Zoologists, American Society of Parasitologists and American Society of Naturalists.

William Byrd Hotel: Section on Mathematics (A), American Mathematical Society, Mathematical Association of America and National Association of Biology Teachers.

Note: A local committee on housing, of which Mr. Foley F. Smith, A.B.C. Laboratory, Richmond, Va., is chairman, will assist visitors to secure satisfactory accommodations. Mr. Smith's committee will have an information desk at the Mosque and at each of the principal hotels during the first three days of the meeting.

TRANSPORTATION

Richmond is on the through north and south route of both the Atlantic Coast Line and the Seaboard Air Line railways, which operate daily during the winter season such *de luxe* trains as the Orange Blossom Special, the Palmetto Limited, the Seaboard Florida Limited and the Havana Special. Richmond may be reached conveniently from western Virginia, North Carolina and South Carolina, and from Tennessee, Alabama, Mississippi and Louisiana by the Southern Railway System. Scientists from the West may go to Richmond via the Baltimore and Ohio Railroad or the Pennsylvania Railroad through Washington, or directly over the Chesapeake and Ohio lines. There are thirteen daily passenger trains each way between Washington and Richmond, which are only about one hundred miles apart. Altogether more than fifty passenger trains arrive in and depart from Richmond each day and more than seventy buses, while there is daily air service from both the north and the south to its municipal airport.

The railroads have not reached a decision respecting whether reduced rates will be in effect during the period of the meeting. Information respecting special holiday rates may be obtained from local railway representatives. At the present rate schedules, round-trip first-class fares to Richmond, exclusive of Pullman fares, from representative cities are as follows: Boston, $32.80; New York, $18.90; Philadelphia, $13.50; Baltimore, $7.80; Washington, $5.50; Atlanta, $27.20; New Orleans, $41.20; Cleveland, $31.60; Ann Arbor, $41.80; Columbus, $33.20; Indianapolis, $44.35; Chicago, $50.90; St. Louis, $56.95; San Francisco, $132.35.

OFFICIAL MEETINGS

The Executive Committee, to which matters for the council are first submitted, will meet daily at 10:00 in the Salon of the Jefferson Hotel. The council of the association will meet at 2:00 o'clock on Tuesday, December 27, and thereafter daily at 9:00 A. M. in the Salon of the Jefferson Hotel. The council will elect a president and other officers of the association at its meeting on Friday morning, December 30.

The Academy Conference will be held on Tuesday at 4:00 in the Salon of the Jefferson Hotel. The conference will be followed by a complimentary dinner to official representatives of the affiliated academies and designated representatives of the association.

The Secretaries Conference will be held on Friday at 4:00 in the Salon of the Jefferson Hotel, followed by a complimentary dinner to the secretaries of the sections and of affiliated societies.

ANNUAL SCIENCE EXHIBITION

The annual science exhibition, which will be conveniently housed in the Mosque, will include exhibits both of research laboratories and of manufacturers of scientific apparatus and equipment. The outstanding books on science published during 1937 will be on display and available for examination. Tickets of admittance to the science exhibition will be given to all registrants for the meeting. The Lounge of the Mosque, adjacent to the exhibits, will be found a con-

venient and attractive place for informal gatherings of scientists.

A school science fair by the high schools of Virginia will be held in the lobby of the Hotel Jefferson from Tuesday to Friday, inclusive. Cash prizes will be awarded for excellence of material and presentation. The fair is directed by Dr. Ira A. Updike, of Randolph-Macon College.

General Sessions

All evening sessions will be held in the Auditorium of the Mosque.

Tuesday, December 27. Address of the retiring president, Dr. George D. Birkhoff, on the subject "Intuition, Reason and Faith in Science." The Mosque, 8:15.

The address will be followed by a reception under the auspices of the Local Committee at the Jefferson Hotel.

Wednesday, December 28. Annual address under the joint auspices of the association and the Society of the Sigma Xi will be delivered by Dr. W. F. Durand on the subject, "Modern Trends in Air Transport." Mosque, 8:15.

At 9:30 in the same room Dr. David Sarnoff will deliver an address under the auspices of the association on some subject related to the social significance of modern means of communication.

Thursday, December 29. The annual address under the auspices of the United Chapters of Phi Beta Kappa will be delivered by Dr. Frank Pierrepont Graves on the subject, "Is Education a Science?" Mosque, 8:15.

"Virginia Homes and Gardens," by Dr. Wm. T. Sanger, president of the Medical College of Virginia, illustrated by slides, in natural colors, by Mr. Max Freydeck. Richmond Women's Club Auditorium, 4:00.

Sir Richard Gregory, distinguished scientist and editor of *Nature*, will deliver an address on the general subject of the effects of science on civilization, 8:15.

Friday, December 30. The concluding session of the symposium on Mental Health will be an address by Dr. C. Macfie Campbell on "Man's Behavior, Beliefs and Values as a Field for Systematic Investigation." Mosque, 8:15.

Saturday, December 31. "National Geographic Society Motion Pictures of Wild Animal Capture," by Dr. Wm. M. Mann, director of the National Zoological Park, Washington. Mosque, 10:30.

Breakfasts, Luncheons and Dinners

Tuesday, December 27

Dinners: American Meteorological Society, Ewarts Hotel. Section on Chemistry (C), Richmond Hotel. Section on Astronomy (D), Jefferson Hotel.

Wednesday, December 28

Breakfast: Pi Mu Epsilon, William Byrd Hotel.

Luncheons: Subsection on Dentistry, Rueger Hotel. Sigma Delta Epsilon, Ewarts Hotel.

Dinners: Entomologists, John Marshall Hotel. American Phytopathological Society, Jefferson Hotel. American Society of Plant Physiologists, Ewarts Hotel. Section on Psychology and Section on Education, Jefferson Hotel. American Society of Taxonomists, Jefferson Hotel. National Association of Biology Teachers, William Byrd Hotel. Ecological Society of America, Murphy Hotel. Biologists' Smoker, John Marshall Hotel.

Thursday, December 29

Breakfast: Sigma Delta Epsilon, Ewarts Hotel.

Luncheons: American Society of Parasitologists, Richmond Hotel. Genetics Society of America, Cabannis Hall, Medical College of Virginia. American Science Teachers Association, John Marshall Hotel. American Nature Study Society, Ewarts Hotel. Gamma Alpha, (place to be announced). The University of Chicago Botanical Alumni, Commonwealth Club.

Dinners: American Society of Zoologists, Richmond Hotel. Botanical Society of America, Jefferson Hotel. American Society for Horticultural Science, Commonwealth Club.

Friday, December 30

Luncheon: Pi Gamma Mu, Jefferson Hotel.

Dinners: American Society of Naturalists, John Marshall Hotel. Section on Anthropology (place to be announced).

Excursions and Short Trips

Historic Williamsburg. Excursions to Williamsburg have been arranged for Wednesday, Thursday and Friday. Buses will leave the John Marshall Hotel at 9 A.M. and will return by 5 P.M. The cost of transportation for the 100-mile trip, admissions to the exhibition buildings, official guides and luncheon will be $4.50 per person. Tickets will be on sale at the Mosque and at the information desks in all the principal hotels in Richmond.

Williamsburg, recently restored as perhaps the most interesting historic shrine in America, was settled as Middle Plantation in 1633, at the time only a palisaded barrier against the Indians. It became the capital of Virginia in 1699, its name being changed in honor of King William III, and remained the capital until 1799. In it is the College of William and Mary, founded in 1693 and the second oldest college in the United States. Jamestown, where in 1607 the English established the first permanent settlement in America, is only six miles away, while Yorktown, where the struggle for American independence ended in victory, is at a distance of only fifteen miles.

Tickets for the following industrial plant tours may be obtained from the Plant Tour Committee at the John Marshall Hotel. The tickets, 25 cents each, include transportation from the John Marshall Hotel to the industry and return. Additional special tours will be arranged.

The American Tobacco Company. Wednesday and Thursday at 10:00, 10:45, 11:30, 1:15, 2:00 and 3:00.

The company will open the doors of one of its air-conditioned factories, in which every stage of manufacture from the leaf to the finished product will be exhibited. Cigarettes will be produced at the rate of 10,000,000 an hour, the federal tax on which is $240,000 per day.

Southern Biscuit Company. Wednesday and Thursday at 10:00 and 2:00. The company operates a plant using the most modern methods in baking. Many of its products are from the famous recipes of Old Virginia, some of them dating back to 1847. The cakes and cookies under the trade symbol F.F.V. are known throughout America and a score of foreign countries. The exhibition will be olfactory as well as optical.

Home Brewing Company. Wednesday and Thursday at 10:00, 11:15, 1:15 and 2:15. The location of the plant has been the site of a brewery since 1865, having been chosen originally because of the famous Buchanan Spring on the property.

Virginia Electric Power Company. Thursday at 10:00 and 2:00. This modern plant will be of special interest because at the time of the meeting a topping turbine and related equipment will be taken down for its annual inspection.

Symposia and Joint Sessions

Section on Mathematics (A). On Wednesday morning the section will hold a joint session with the Section on Geology and Geography (E), the Mathematical Association of America and the American Mathematical Society at which the retiring chairman of the section, Professor W. D. Cairns, will deliver his vice-presidential address on "Seismology from the Mathematical Point of View."

Section on Chemistry (C). On Tuesday morning the section will present a symposium on "Reaction Rates in Organic Chemistry," on which papers will be delivered by Drs. Farrington Daniels, F. O. Rice, Gustav Egloff, Everett S. Wallis and Edward Mack, Jr. On Tuesday afternoon the section will present a symposium on "Natural Resins." The papers will be delivered by Drs. J. N. Borglin, Wm. Howlett Gardner and S. Palkin. On Wednesday morning the section will present a symposium on "Phenanthrene and Related Compounds." The papers will be by Drs. Harry Sobotka, Walter A. Jacobs, Lyndon F. Small, Erich Mosettig, Everett S. Wallis and R. E. Marker.

Section on Geology and Geography (E). On Tuesday morning the section will hold a joint session with the Geological Society of America and the Carolina Geological Society on "Geology of the Coastal Plain." On Tuesday afternoon the section will hold a joint session with the Section on Astronomy, the American Geophysical Union and the Geological Society of America on the "Importance of Geophysics to the Study of Continental Borders." On Wednesday morning, following the joint session with the Section on Mathematics, referred to above, the address of the retiring vice-president, Professor Kirtley F. Mather, will be delivered on the subject "Earth Structure and Earth Origin." On Wednesday afternoon the section will hold a joint session with the Geological Society of America and Carolina Geological Society on "Current Geological Research in the Piedmont and Central Appalachians." On Thursday morning the section will meet in joint session with the Society for Research on Meteorites and the Geological Society of America on "The Origin of the Carolina Bays."

American Society of Zoologists. On Wednesday afternoon the society joins with Genetics Society of America in a symposium on "Chromosome Structure." On Thursday morning the society will present a symposium on "Color Changes in Animals, their Significance and Activation," Dr. G. H. Parker presiding. The speakers will be Drs. G. H. Parker, H. B. Goodrich, A. A. Abramowitz, F. B. Sumner, D. C. Smith and F. A. Brown, Jr. On Friday morning the society will present a symposium on "Mating Types and their Interactions in Ciliate Infusoria; Determination, Inheritance and Relation to Sexuality," Dr. H. S. Jennings presiding. The speakers will be Drs. H. S. Jennings, T. M. Sonneborn, A. A. Giese, Lauren Gilman and Richard Kimball. On Friday afternoon the American Society of Naturalists, the American Society of Zoologists, the Botanical Society of America, the Genetics Society of America and the Section on Anthropology (H) will hold a joint session on "Contributions of Higher Animals to an Understanding of Human Biology." The papers will be by G. K. Noble, C. C. Little and Carl G. Hartman.

The Entomological Society of America, the American Association of Economic Entomologists and the Ecological Society of America will present a joint symposium on Tuesday afternoon on "Insect Populations," Dr. V. E. Shelford presiding.

Ecological Society of America and the Society of American Foresters will hold a joint session on Wednesday afternoon.

Limnological Society of America will present a symposium on "Some Leading Problems of Limnology, with Special Reference to Lakes."

Section on Botanical Sciences (G). On Wednesday afternoon the section will hold a joint session with its affiliated societies.

Botanical Society of America, American Society of Plant Physiologists and American Society for Horticultural Science will hold a joint session on Thursday morning.

Ecological Society of America and the general sec-

tion of the Botanical Society of America will meet in joint session on Thursday afternoon.

Botanical Society of America and American Society of Naturalists and affiliated societies will meet in joint session on Friday afternoon.

Botanical Society of America, physiology section, and American Society of Plant Physiologists will hold a joint session on Friday morning on "The Physiology and Diseases of Cotton."

American Phytopathological Society and American Association of Economic Entomologists will hold a joint meeting on Thursday afternoon on "Problems of Regulatory Work."

American Phytopathological Society and Potato Association of America will meet in joint session on Friday morning on "Potato Disease Control." Among the speakers will be Drs. T. P. Dykstra, Donald Reddick, W. R. Mills, E. S. Schultz and J. G. Leach.

American Phytopathological Society and the floriculture section of the American Society for Horticultural Science will hold a joint session on Friday morning on "Disease Control of Ornamentals."

American Phytopathological Society and the Mycological Society of America will meet in joint session on Friday morning.

Section on Anthropology (*H*) will present a symposium on "The Archeology of the Atlantic Coast Area." On Friday afternoon the section will hold a joint session with the American Society of Naturalists, the general theme of discussion being the relation of the higher primates to human welfare.

Section on Psychology (*I*) and the Section on Education (Q) will hold a joint session on Wednesday afternoon.

Section on Historical and Philological Sciences (*L*) will present a symposium on Tuesday morning and afternoon on "The Centenary of the Cell Theory." The speakers will be Drs. E. G. Conklin, L. L. Woodruff, J. S. Karling, Franz Schrader and Paul Weiss.

Section on Medical Sciences (*N*) will present a symposium on "Mental Health" consisting of six sessions, mornings and afternoons, on Wednesday, Thursday and Friday, and a General Session on Friday evening. The chairmen of the six sessions will be Drs. Nolan D. C. Lewis, Abraham Myerson, Joseph Zubin, Harry Stack Sullivan, Clarence M. Hincks and Franklin G. Ebaugh. About fifty persons will present papers at the six sessions. The address at the General Session on Friday evening will be by Dr. C. Macfie Campbell on "Man's Behavior, Beliefs and Values as a Field of Systematic Investigation."

Subsection on Pharmacy of the Section on Medical Sciences will present a symposium on "Glycols." The speakers will be Drs. Frank C. Whitmore, H. O. Calvery, H. B. McClure, A. G. DuMez and H. B. Haag.

American Society for Horticultural Science and the Potato Association of America, affiliated with the Section on Agriculture (O), will hold a joint session on Wednesday afternoon.

Section on Education (*Q*) will present a symposium on "Problems of Interpretation of Educational Research," under the chairmanship of Dr. W. H. Bristow.

Section and Society Programs

Section on Mathematics (*A*). The section will hold a session on Wednesday morning jointly with the Section on Geology and Geography (E), the American Mathematical Society and the Mathematical Association of America, at which Professor W. D. Cairns will deliver his address as retiring vice-president of the association and chairman of the section on "Seismology from the Mathematical Point of View."

Section on Physics (*B*). On Friday evening Dr. Harvey Fletcher will deliver a demonstration-lecture as retiring vice-president of the association and chairman of the section on "Auditory Patterns."

Section on Chemistry (*C*). The program will consist of four sessions on Tuesday and Wednesday, the first three of which will be for the presentation of symposia (see foregoing report on symposia and joint sessions). In the first session on Tuesday morning Dr. Farrington Daniels will deliver his address as retiring vice-president of the association and chairman of the section on "Reaction Rates." The fourth session on Wednesday afternoon will consist of a round-table conference, led by Dr. Lewis W. Butz, on "A Systematic Nomenclature for the Saturated Hydrocarbons, from which Steroids are Derived and its Derivatives, with Special Regard to Stereoisomers and Synthetic New Steroids," and of five additional papers on various subjects by Drs. C. G. King, Hans Neurath; Albert H. Cooper, Carl D. Delamar and Henry Smith; J. E. Copenhaver and James F. Goggins, Jr., and Sister M. Lawrence and William Schiller. At the four sessions 20 papers will be presented in addition to the round-table conference. On Tuesday evening the section and its friends will join in a dinner in honor of Dr. Farrington Daniels, retiring chairman of the section.

Section on Geology and Geography (*E*) *and Affiliated Societies.* Of the six sessions of the section, which will be held on Tuesday, Wednesday and Thursday, the first five are joint meetings (see foregoing report on symposia and joint meetings) and the last on Thursday afternoon is devoted to "The Geography of Virginia and the Carolinas." On Wednesday morning Professor Kirtley F. Mather will deliver his address as retiring vice-president of the association and chairman of the section on "Earth Structure and Earth Origin," and addresses in honor of the memory of

William Barton Rogers will be delivered by Drs. Arthur C. Bevan and Joseph H. Roberts and probably others. With geologists, geographers, physicists, astronomers and seismologists participating in its sessions, the section presents a program which integrates to an exceptional degree related fields of science. At least 40 papers will be presented at the six sessions of the section and its cooperating section and societies.

The American Meteorological Society will meet Tuesday and Wednesday. Papers on meteorological service fifty years hence will be presented by President Robert E. Horton and W. C. Devereaux as a tribute to the late President Willis R. Gregg, who died in September. The first award of the Meisinger Aerological Research Fund prize will be made. Papers on hydrometeorology, air-mass analysis, aerology and the recent hurricane will feature the program.

Section on Zoological Sciences (F) and Affiliated Societies. No section has stronger or more active affiliated societies than has section F. Consequently, in order to serve most effectively the interests of zoology, the American Society of Zoologists, the Entomological Society of America, the American Association of Economic Entomologists, the American Society of Parasitologists and the Ecological Society of America organize the programs in the field of zoology.

The American Society of Zoologists will hold sessions on Wednesday, Thursday and Friday. The program on Wednesday morning will be presented in four sections: A. Experimental Embryology (10 papers). B. Endocrinology (12 papers). C. General Physiology (16 papers). D. Protozoology and Parasitology (11 papers). On Wednesday afternoon the society joins with Genetics Society of America in presenting a symposium on "Chromosome Structure." On Wednesday evening the society joins in the Biologists' Smoker. The program on Thursday morning will be presented in four sections: A. Symposium on "Color Changes in Animals, Their Significance and Activation" (6 papers). B. Endocrinology (continued; 14 papers). C. Cellular Physiology (12 papers). D. Experimental Embryology (10 papers). The annual business meeting of the society will be held on Thursday at 12:10. Thursday afternoon will consist of demonstrations as follows: Two 15-minute motion picture films, six demonstrations in cytology, four in embryology, three in physiology and endocrinology, and nine in general morphology and miscellaneous subjects. The Zoologists' Dinner will be held on Thursday evening. On Friday morning the program will be presented in four sections: A. Mating Types and their Interactions in Ciliate Infusoria; Determination, Inheritance and Relation to Sexuality (6 papers). B. Cytology and Histology (12 papers). C. General Physiology (13 papers). D. General Morphology and Miscellaneous (9 papers). On Friday noon there will be a Biologists' Luncheon. On Friday afternoon the society will meet in joint session with the American Society of Naturalists, Botanical Society of America, Genetics Society of America and the Section on Anthropology (H) for a program on "Contributions of Higher Animals to an Understanding of Human Biology." In addition to the 161 papers in the foregoing listed programs, there will be 98 papers read by title, 18 on Embryology, 19 on General Physiology, 11 on Cellular Physiology, 16 on Endocrinology, 11 on Cytology and Histology, 5 on Protozoology, 8 on Ecology and Parasitology and 10 on General Morphology.

The Entomological Society of America holds its thirty-third annual meeting on Tuesday, Wednesday and Thursday. On Tuesday afternoon it joins with other societies in a symposium on "Insect Populations" (see foregoing report on symposia and joint sessions). Dr. A. L. Melander will preside at the sessions of the society for the presentation of general papers. The society will join related societies in the annual Entomologists' Dinner, at which the annual address of the society will be delivered by Dr. C. T. Brues on "Food, Drink and Evolution."

The American Association of Economic Entomologists, in addition to participating in the symposium on "Insect Populations," will hold sessions on Monday, Tuesday, Wednesday, Thursday and Friday. On Monday the society will convene for two special conferences, the tobacco insect council and the pea aphis conference. On Tuesday there will be section meetings on apiculture, a continuation of the pea aphis conference and the teaching of entomology. The section on plant quarantine will meet all day on Wednesday and Thursday and the extension section will meet on Wednesday night.

The American Society of Parasitologists will hold sessions on Wednesday, Thursday and Friday. The principal feature on Thursday afternoon will be a demonstration program and a tea. On Thursday morning Dr. F. C. Bishopp will deliver an address on "Some Problems in Medical and Veterinary Entomology." A parasitologists' luncheon will be held on Thursday noon. The program, consisting of 67 papers and demonstrations, will be the largest in the history of the society.

Section on Botanical Sciences and Affiliated Societies. The sessions of the section and of its affiliated societies will be held on Tuesday, Wednesday, Thursday and Friday. On Wednesday afternoon, the section and its affiliated societies will hold a joint session (see foregoing report on symposia and joint sessions).

The Botanical Society of America will hold sessions on Wednesday, Thursday and Friday. On Thursday morning its physiological section will meet with the

American Society of Plant Physiologists and with the American Society for Horticultural Science; on Thursday afternoon the general section of the society will meet with the Ecological Society of America; and on Friday afternoon the society will meet with the American Society of Naturalists and affiliated societies. At the annual dinner for all botanists on Thursday evening, Dr. Edmund Ware Sinnott will deliver an address as retiring president of the society.

The American Phytopathological Society will hold its thirtieth meeting on Tuesday, Wednesday, Thursday and Friday. At a general session on Tuesday afternoon, Dr. C. W. Bennett will deliver an invitation paper on "Nomenclature of Plant Viruses" to be followed by a conference on the same subject and a conference on "Plant Disease Survey" in the evening. On Wednesday afternoon, the extension plant pathologists will hold a conference on "Methods of Seed Treatment," and the section will hold a joint session with the Section on Botanical Sciences and its affiliated societies. On Thursday afternoon the society will hold a joint session with the American Association of Economic Entomologists, and on Friday morning the society will hold a joint session with the Potato Association of America. On Friday the society will hold joint sessions with the Floriculture Section of the American Society for Horticultural Science and with the Mycological Society of America. A joint session is being planned with the Physiology Section of the Botanical Society of America and the American Society of Plant Physiologists on the "Physiology and Diseases of Cotton." In addition to the foregoing joint sessions, the society will hold a general session on Tuesday afternoon; three different sectional meetings on Wednesday morning on "Diseases of Fruits," "Diseases of Cereal Crops" and "Diseases of Vegetables"; and on Thursday morning three sectional meetings on "Forest Trees," "Tobacco" and "Miscellaneous Crops." A total of approximately one hundred papers will be presented on different phases of plant pathology.

The dinner of phytopathologists will be held on Wednesday evening.

The Mycological Society of America will meet on Wednesday, Thursday and Friday. On Wednesday morning the retiring president, Dr. L. O. Overholts, will deliver an address, after which short papers will be presented. On Wednesday afternoon the society will meet with other societies in the field of botany in a joint session, and with the American Phytopathological Society on Friday morning. The other sessions of the society will be dealing with such subjects as "The Taxonomy of Fungi," "The Effect of Growth-promoting Substances" and "The Parasitism of Man and Fish by Fungi." The society will join with related societies in their annual dinner.

The American Fern Society will hold a symposium on Saturday morning on "The Ferns of Virginia and Adjoining States."

Societies affiliated with Sections on Zoological Sciences and on Botanical Sciences. The Ecological Society of America, in addition to joining with other societies in a symposium on "Insect Populations" and holding a joint session with the Botanical Society of America and the Society of American Foresters (see foregoing report on symposia and joint sessions), has planned a field trip for Friday, and will hold its annual banquet on Wednesday evening, at which the presidential address will be delivered by Dr. H. C. Hanson.

The Genetics Society of America will hold sessions on Wednesday, Thursday and Friday. On Wednesday morning the program will consist of twenty demonstration papers and in the afternoon of a joint symposium with zoologists on "Chromosome Structure." The program on Thursday morning will consist of eighteen demonstration papers, a luncheon and business meeting at noon and an afternoon session, consisting of six invitation papers by Drs. M. L. Suche, D. R. Parker, M. Bishop, A. B. Griffen; A. Hollaender and C. W. Emmons; C. W. Metz and H. V. Crouse; W. P. Spencer; G. Fankhauser; and E. R. Sears. The program on Friday morning will consist of ten short papers and on Friday afternoon the society will meet in joint session with the American Society of Naturalists, the subject of discussion being "Contributions of Higher Animals to an Understanding of Human Biology." The contributors to the discussion will be Drs. G. K. Noble, C. C. Little and Carl G. Hartman.

The Limnological Society of America will hold its fourth annual meeting in conjunction with the association on Wednesday, Thursday and possibly Friday forenoon. In addition to two or three general sessions for the presentation of research papers, there will be a symposium on some leading problems of limnology with special reference to lakes. There will be nine or ten participants in the symposium and the research papers will be on such topics as limnological methods and apparatus, lake sedimentation, bacteria in natural waters, lakes of Argentina, and an invitation paper on sedimentation in reservoir lakes.

The Section on Anthropology (H) will hold sessions on Thursday and Friday. At the annual section dinner on Friday evening, Dr. John R. Swanton will deliver an address as retiring vice-president of the association and chairman of the section, on "Some Thoughts on the Problems of Progress and Decline." The section will present a symposium on "The Archeology of the Atlantic Coast region," and on Friday will hold a joint session with the American Society of Naturalists, the American Society of Zoologists, the Botanical Society of America and the Genetics So-

ciety of America. The general subject to be discussed in the joint session will be "The Relation of the Higher Primates to Human Welfare."

The Section on Psychology (*I*) will hold six separate program sessions on Tuesday, Wednesday and Thursday. The topics of experimental psychology, social psychology, animal psychology and abnormal psychology will be emphasized. The morning session on Tuesday, under the chairmanship of Dr. J. F. Dashiell, will consist of papers by Drs. William E. Galt, Jack Buel, W. J. Brogden, W. Horsley Gantt and Norman R. F. Maier. The Tuesday afternoon session, under the chairmanship of Dr. Calvin P. Stone, will consist of papers by Drs. G. H. S. Razran, Albert Ford and George F. Derr, John A. McGeoch, H. B. English and A. L. Edwards, Arnold Gesell and Wayne Dennis. The morning session on Wednesday will be devoted to a symposium under the chairmanship of E. A. Culler on the "Next Steps in Research in Audition." The speakers will be Drs. J. C. Steinberg, Don Lewis, Fred A. Mettler, E. H. Kemp, Heinrich Kobrak, Simon Dwarkin and Walter Hughson.

The afternoon session on Wednesday will be held in two sections, one under the chairmanship of Dr. Norman L. Munn, at which the speakers will be Drs. Frank A. Geldard, J. G. Beebe-Center, Richard S. Schultz, J. H. and C. P. Heinlein, Louis D. Goodfellow and David I. and Moses B. Macht. The other section will be a joint session with the Section on Education (see report of section), under the chairmanship of Dr. Frank A. Geldard. On Thursday morning one section will be under the chairmanship of Dr. John A. McGeoch, at which papers will be presented by Drs. George Lawton, Harriet Babcock, W. J. E. Crissy, A. S. Edwards, S. H. Epstein, Charles M. Diserens, Milton M. Parker, H. Rogosin and Ernst Harms. The other section of the Thursday morning session will be held under the chairmanship of Dr. J. G. Beebe-Center, and the speakers will be Drs. J. E. Greene, Stewart H. Britt, Elaine F. Kinder, Gladys McDermaid, Margaret B. Erb, Bernard F. Riess, H. Meltzer, J. E. Janney and John P. Shea. At the joint dinner of the section with the Section on Education, on Thursday evening, Dr. Calvin P. Stone will deliver his address as retiring vice-president of the association and chairman of the section on "The Significance of Individual Differences in Animal Psychology."

The Section on the Historical and Philological Sciences (*L*) will hold sessions on Tuesday and Wednesday morning. On Tuesday morning and afternoon the section will present a symposium on "The Centenary of the Cell Theory," at which the speakers will be Drs. E. G. Conklin, L. L. Woodruff, J. S. Karling, Franz Schrader and Paul Weiss. On Wednesday morning the section will hold a joint session with the Section on Mathematics, at which Dr. R. C. Archibald will deliver his address as retiring vice-president of the association and chairman of the section on "Mathematicians and Poetry and Drama."

Section on Medical Sciences (*N*). The program of the section consists of six sessions beginning on Wednesday morning and closing on Friday afternoon, all of which will be devoted to its symposium on "Mental Health" (see foregoing report on symposia and joint sessions). In connection with one of these sessions, Dr. Charles F. Code, winner of the Theobald Smith Award at the Ottawa meeting of the association, will present a paper on "The Blood Histamine in Normal and Certain Abnormal Conditions." At another session there will be a memorial address on the late Dr. Earl B. McKinley, to whom the section, as well as the entire association, is deeply indebted. On Friday evening the section will hold a general session, at which Dr. C. Macfie Campbell will deliver an address on "Man's Behavior, Beliefs and Values as a Field for Systematic Investigation."

The Subsection on Pharmacy of the section will present a symposium on "Glycols" on Tuesday morning, at which four invited papers will be presented by Drs. Frank C. Whitmore, H. O. Calvery, H. B. McClure and A. G. Du Mez, after which the discussion will be held by Dr. H. B. Haag.

The American Society for Horticultural Science will hold its thirty-fifth meeting on Wednesday, Thursday and Friday. In addition to various sectional meetings on plant breeding, general cultural problems of horticultural crops, tree fruits, small fruits, vegetable crops and floriculture and ornamental horticulture, there will be three joint sessions. The Vegetable Crops section will meet on Wednesday afternoon in joint session with the Potato Association of America. On Thursday morning there will be a joint session with the American Society of Plant Physiologists and the Physiology Section of the Botanical Society of America on "Low Temperature Injury to Plants." The section on Floriculture and Ornamental Horticulture will meet on Friday morning with the American Phytopathological Society. The annual banquet will be held on Thursday evening, December 29, at which time the retiring president, Dr. J. K. Shaw, will deliver the principal address.

Section on Education (*Q*). The section will hold sessions on Wednesday and Thursday. In addition to a program of general papers there will be special programs on "Problems in Reading," with Dr. Emmett A. Betts as chairman; on "New Developments in Education," with Dr. George D. Stoddard as chairman; and on "Economic Effects of Education," with Dr. W. G. Carr as chairman. There will be a session devoted to "Reports of National and State Surveys in Educa-

tion." Dr. F. W. Reeves will report on the work of the President's Advisory Committee on Education, Dr. H. F. Alves on "State and Local Units in Ten States," and Walter C. Eells on "The Cooperative Study of Secondary School Standards." There will also be a report on the American Youth Commission. A symposium is being organized on "Problems of Interpretation of Educational Research," under the chairmanship of Dr. W. H. Bristow. There will be a round-table discussion on "Mental Hygiene in Education," led by Dr. Garry C. Myers. On Wednesday afternoon the section will hold a joint session with the Section on Psychology under the chairmanship of Dr. Frank A. Geldard, at which papers will be presented by Drs. Joseph Zubin, F. H. Lewis, F. P. Robinson, Henry F. Dickinson, Richard H. Henneman, Arnold Gesell and J. E. Greene and R. T. Osborne. At the joint dinner with the Section on Psychology on Wednesday evening, Dr. Ralph W. Tyler will deliver his address as retiring vice-president of the association and chairman of the section on "Basic Considerations in the Improvement of Educational Tests."

Other Programs

American Science Teachers' Association. On Wednesday evening the society will hold a dinner and conference, and on Thursday morning it will present a program of three papers, with Dr. W. L. Eikenberry presiding, the papers being by Dr. Philip R. White on plant physiology, Dr. Charles S. Piggot on the bottom of the ocean, and Dr. Harlan T. Stetson on solar activities. On Thursday the society will hold a luncheon, with Dr. Otis W. Caldwell presiding and Dr. Wesley C. Mitchell, president of the association, as its speaker. On Thursday afternoon the society will hold a session, Harry A. Carpenter presiding, in which Jerome Isenbarger, Hanor A. Webb and Karl F. Oerlein will speak.

The Sigma Delta Epsilon fraternity will hold a luncheon for members and guests on Wednesday noon.

The American Nature Study Society will hold meetings on Wednesday and Thursday. On Wednesday morning there will be a nature study program of miscellaneous topics, on which the speakers will be Drs. P. L. Ricker, Frank Thone and William A. Matheny. On Wednesday afternoon the subject will be "The Conservation of Wild Life." Dr. David E. Russell will deliver an address introductory to a panel discussion under the chairmanship of Dr. E. Laurence Palmer. The participants in the discussion will be Drs. Harry Cunningham, James W. McArthur, F. L. Ricker, Malvina Trussell, Charles Quaintance, C. W. Pomerat and Paul B. Sears. On Thursday morning the society will celebrate the thirtieth anniversary of its organization, the speakers being former presidents of the society. Dr. Edith Patch, presiding, will discuss "Looking Forward." Dr. Otis W. Caldwell will follow on "What Seems to be Ahead"; Dr. William G. Vinal, on "The New Nature Guide School of Massachusetts State College"; Dr. Morrison R. Van Cleve, on "In Defence of the Nature Study Idea"; Dr. George Rex Green, on "Teacher Training for Nature Study and Science"; Dr. Bertha Chapman Cady, on "A Northerner Looks at Nature in Tropical Florida"; Dr. Alfred Satterthwait, on "The Society and the Amateur"; and Dr. E. Laurence Palmer on "Cycles and Sequences in the Philosophy of Nature Study." On Thursday at one o'clock there will be a luncheon, at which Drs. Carroll Lane Fenton and F. R. Moulton will speak.

The seventeenth Annual Lecture presented under the joint auspices of the Society of the Sigma Xi and the association will be delivered on Wednesday evening by Dr. W. F. Durand on "Modern Trends in Air Transport."

The United Chapters of Phi Beta Kappa on Thursday evening will present the fourth of its series of annual lectures at a meeting of the association. The speaker will be Dr. Frank P. Graves on the subject, "Is Education a Science?"

SCIENTIFIC EVENTS

BIBLIOFILM SERVICE IN THE GEOLOGICAL SURVEY

To give research workers throughout the country access to further materials for their work, a Bibliofilm Service has been opened in the Library of the Geological Survey, Washington, D. C. Through the courtesy of Guy E. Mitchell, librarian, it is now possible for a scholar anywhere to have copied any properly copyable extracts from the quarter million books, journals and rare materials in the library, as well as many of its fifty thousand maps.

Bibliofilm Service is operated on a non-profit basis by the American Documentation Institute under a cooperative agreement with the Library of the U. S. Department of Agriculture, and also maintains copying installations in that library and in the Army Medical Library. It acts as a national clearing house for copying orders for research materials, filling them through its own and other services, for materials in substantially all Washington and Baltimore libraries, bureaus and institutions and in other cities here and abroad.

Copying is done in either of two forms: microfilm (a series of still images on 35 mm. standard safety photographic film comfortably usable in reading machines now widely available) at 1 cent per page, plus a fixed service charge of 20 cents; or in the form of photoprints (6×8 in. legible without optical aid) at 10 cents per page, plus service charge of 20 cents.

Inquiry should be in the form of a definite order for the copying of specific materials; if available and properly copyable, the order will be filled. Order blanks making a letter unnecessary are available free on request. Remittance must accompany order, or an amount of $5 or more may be sent to open the usual deposit account, which saves the necessity of remitting small sums. Information on reading machines may be obtained from Science Service, Washington, D. C., who also supply a hand viewer invented by Dr. Atherton Seidell, suitable for reading short extracts.

The additional resources now opened to research workers everywhere, through Bibliofilm Service in the Geological Survey Library, comprise everything properly copyable among over 250,000 volumes, including geology, mining, paleontology, mineralogy, chemistry, 50,000 geologic and other maps, United States and foreign; some 1,200 foreign and domestic periodicals and serials, including reports of State Surveys and Mining Bureaus, all governmental publications on the above subjects and the geological publications obtained by exchange from every foreign government. There are many surprising finds; items not duplicated in any other American library; some exceedingly rare and useful aggregations.

Remittance for copying material in the Geological Library, or material in other fields in other libraries, should be made payable to the American Documentation Institute, and all orders for copying should be mailed to Bibliofilm Service, care U. S. Department of Agriculture Library, Washington, D. C.

ESTABLISHMENT OF THE FRANK P. BROWN MEDAL OF THE FRANKLIN INSTITUTE

THE Franklin Institute announces the establishment of a silver medal, to be known as the Frank P. Brown Medal, to be awarded to "inventors for inventions and discoveries involving meritorious improvements in the building and allied industries." In a statement made by Dr. Henry Butler Allen, secretary of the institute, speaking on behalf of the Board of Managers, he said that the expression "building and allied industries" is intended to include design and construction of buildings as well as appurtenant equipment within this industry.

Mr. Brown, who left the fund for this medal, was engaged in the plumbing business and metal manufacturing. He became a member of the Franklin Institute in 1875. He served on the Committee on Science and the Arts from 1879 to 1910, was reelected in 1933 and continued a member until his death. He was chairman of the Jury on Lighting at the National Export Exposition conducted by the institute and the Commercial Museum in 1899.

Medals which have been recommended and duly approved are awarded on "Medal Day," an annual event taking place in the month of May. A subject may be investigated if the project is presented in writing to the secretary of the Committee on Science and the Arts, made up of leaders in the fields of engineering, physics, chemistry, astronomy, metallurgy and professional business men of established reputation. Full and complete information must be submitted together with copies of such patents as may have been granted. If a careful and thorough preliminary examination of the matter discloses the subject to possess real value and to embody distinctly new principles, it is considered by a group of experts. Should a favorable recommendation be made, the case, upon ratification by the committee, may subsequently be referred to a small group of specialists for thorough and searching study.

In 1824, the year The Franklin Institute was founded, this committee was organized under the name of "Committee on Inventions," and its name was changed ten years later to "Committee on Science and the Arts." It has functioned without interruption for a period of one hundred and fourteen years, in the course of which it has passed upon upwards of 3,000 cases and has determined important awards. Among those who have been recipients of various medals are Alexander Graham Bell, Juan de la Cierva, Thomas A. Edison, Charles F. Kettering, Guglielmo Marconi and Elmer A. Sperry. The medals under the jurisdiction of the group are the Franklin Medal, the Elliott Cresson Medal, the Howard N. Potts Medal, the Louis Edward Levy Medal, the George R. Henderson Medal, the Walton Clark Medal, the John Price Wetherill Medal and the Edward Longstreth Medal. A certificate of merit is also recommended by this committee.

MEAD JOHNSON AND COMPANY "B-COMPLEX" AWARD

IN order to promote interest in researches dealing with the water-soluble "B-complex" vitamins, Mead Johnson and Company have established an annual award of $1,000 to be given over a period of five years through the medium of the American Institute of Nutrition. The institute, through an appropriate committee of judges selected from its membership, will name the recipient of this award; the formal presentation of it will be made as part of the program of the annual meeting held each spring.

The award will be given to the laboratory (non-clinical) or clinical research worker in the United States or Canada, who, in the opinion of the judges, has published during the previous calendar year, January 1 to December 31, the most meritorious scientific report dealing with the field of the "B-complex" vitamins. While the award will be given primarily for publication of specific papers, the judges will be given considerable latitude in the exercise of their function. If in their judgment circumstances and justice so dictate, it may be recommended that the prize be divided between two or more persons. It may also be recommended that the award be made to a worker for valuable contributions over an extended period, but not necessarily representative of a given year. Membership in the American Institute of Nutrition is not a requisite of eligibility for the award.

To assist the committee of judges in its deliberations relative to this award, nominations are solicited for their consideration. These may be sent any time to the secretary (undersigned) of the American Institute of Nutrition. For a nomination to be considered for the award to be bestowed at any given spring meeting of the institute, however, it must be received by the secretary not later than January 15. The nomination should be accompanied by such data relative to the nominee and his research as will facilitate the task of the committee of judges in its consideration of the nomination.

L. A. MAYNARD,
Secretary, American Institute of Nutrition
LABORATORY OF ANIMAL NUTRITION,
CORNELL UNIVERSITY,
ITHACA, NEW YORK

THE FIFTH INTERNATIONAL CONGRESS FOR THE UNITY OF SCIENCE AT HARVARD UNIVERSITY

THE fifth International Congress for the Unity of Science is to be held at Harvard University from September 5 to 10, 1939.

The theme of the congress is "The Logic of Science"; interest will center upon the relation of the concepts, laws and methods of the various sciences. Attention will be devoted to general problems connected with the unification of science, and, in particular, with the logic of the physical sciences, the relation of the physical and biological sciences and the relation of the biological and socio-humanistic sciences. There will also be a number of special sessions and symposia concerned with special problems and fields.

The International Organizing Committee is composed of R. Carnap, P. Frank, J. Joergensen, C. W. Morris, O. Neurath, H. Reichenbach, L. Rougier and L. S. Stebbing. The American Organizing Committee includes E. T. Nell, P. W. Bridgman, R. Carnap, A. Church, M. Cohen, J. Dewey, H. Feigl, L. J. Henderson, C. J. Herrick, E. V. Huntington, H. S. Jennings, W. Köhler, S. K. Langer, C. H. Langford, K. S. Lashley, V. F. Lenzen, C. I. Lewis, R. S. Lillie, A. O. Lovejoy, R. M. MacIver, W. M. Malisoff, W. P. Montague, C. W. Morris, E. Nagel, F. S. C. Northrop, W. V. Quine, H. Reichenbach, E. Sapir, G. Sarton, H. Schultz, E. C. Tolman, W. Weaver and L. Wirth.

Professor P. W. Bridgman is the chairman and Dr. W. V. Quine is the secretary of the committee on arrangements at Harvard University. The congress is sponsored by the International Committee of the Congresses for the Unity of Science, by the International Institute for the Unity of Science, and, in America, by the American Association for the Advancement of Science, the Philosophy of Science Association, the Association for Symbolic Logic and the American Philosophical Association.

A series of twenty monographs, entitled "Foundations of the Unity of Science" (and constituting the first two volumes of the "International Encyclopedia of Unified Science"), is now being issued by the University of Chicago Press. It helps to provide a background for the congress. Three monographs have already appeared, and it is hoped that all twenty will be in print by the time of the opening of the congress.

Those who wish later notices of the congress are requested to send their names and address to Professor C. W. Morris, University of Chicago, Chicago, Illinois.

INSTALLATION OF THE FLORIDA CHAPTER OF THE SOCIETY OF SIGMA XI

THE Florida Chapter of the Society of the Sigma Xi, national honorary society fostering research in the sciences, was installed at the University of Florida, Gainesville, on October 28, by Dr. Edward Ellery, of Union College, national secretary of the society.

Dr. Charles Carroll Brown, the oldest living past president of Sigma Xi, honored a luncheon by discussing the history and objectives of the society since it was founded in 1886 at Cornell University.

The address of the day by the Honorable M. L. Wilson, Under-Secretary of the United States Department of Agriculture, commemorated installation of the chapter and at the same time celebrated fifty years of service by the Florida Agricultural Experiment Station. He praised the research work of the station in soil science, particularly in the field of minor minerals, plant disease and insect control, plant and animal nutrition, providing techniques and facts of service over a wide area. He also commended the principles of education fostered by the general college, which give broader training to students in keeping with the trend of modern times.

Dr. Ellery addressed members and guests at a banquet on "The Urge to Know." He pointed out that what is called form in these days of 1938 is an appreciation and acknowledgment and encouragement on the part of men everywhere of the irrepressible and irresistible urge to know, the eternal characteristic of human intelligence, always and inevitably pushing on into the unknown.

Officers of the newly installed chapter are: Dr. P. H. Senn, *president;* Dr. C. F. Byers, *vice-president;* Dr. R. B. Becker, *secretary,* and Dr. J. E. Hawkins, *treasurer.* The new chapter has 49 petitioners, whose membership in the national society was earned previously in chapters scattered widely over the United States.

TROPICAL MEDICINE

DR. ERNEST CARROLL FAUST, secretary of the American Academy of Tropical Medicine, writes that the fifth annual meeting of the academy was held on November 17 in Oklahoma City in conjunction with the American Society of Tropical Medicine and the Southern Medical Association. At the after-dinner program of the academy, of which Dr. Henry E. Meleney, of Vanderbilt University, acted as toastmaster, the presidential address, "Some of the Unsolved Problems in Research and Disease Control in the Tropics," was delivered by the retiring president, Colonel Joseph F. Siler, Army Medical School, Washington, D. C. Perry Burgess, president of the Leonard Wood Memorial, delivered a "Tribute to Dr. E. B. McKinley." At the business session the following officers were elected for the coming year:

President, William Walter Cort, the Johns Hopkins University.
Vice-president, Admiral C. S. Butler, Washington, D. C.
Secretary, Ernest Carroll Faust, Tulane University.
Treasurer, Thomas T. Mackie, New York City.
Councillor (5-year term), Herbert C. Clark, Gorgas Memorial Laboratory, Panama.
Councillor (1-year term), George W. Bachman, School of Tropical Medicine, San Juan, Puerto Rico.
Representative on the Council of the American Association for the Advancement of Science, Malcolm H. Soule.
Representative on the American Foundation for Tropical Medicine, Thomas T. Mackie.

The following were elected to active membership in the academy:

Dr. Justin Andrews, malariologist, Georgia State Board of Health.
Dr. George Dunham, lieutenant-colonel, U. S. A., Army Medical School, Washington, D. C.
Dr. Paul Hudson, professor of bacteriology, the Ohio State University.
Dr. L. L. Williams, senior surgeon in charge of malaria control, U. S. Public Health Service, Washington, D. C.

The American Society of Tropical Medicine met from November 15 to 18. The third Charles Franklin Craig Lecture on tropical medicine on "Progress in the Study of Infections Due to Bartonella and Rickettsia" was given by Dr. Richard P. Strong, and there was a symposium on "Newer Clinical Aspects of Deficiency Diseases," which was a joint session of the society with the Section on Medicine of the Southern Medical Association. The presidential address was delivered by Dr. Mark F. Boyd on "The Malaria Problem: Retrospect and Prospect." Officers elected for the year 1939 were:

President, Dr. Alfred C. Reed, San Francisco.
President-elect, Dr. L. L. Williams, Jr., Washington, D. C.
Vice-president, Dr. Sterling S. Cook, Norfolk, Va.
Secretary-treasurer, Dr. E. Harold Hinman, Wilson Dam, Ala.
Editor, Colonel Charles F. Craig, San Antonio, Texas.

New councilors, who were elected for a term of two years, are Dr. Mark F. Boyd and Dr. L. T. Coggeshall.

SCIENTIFIC NOTES AND NEWS

IN accordance with the recommendations made to the King of England by the Council of the Royal Society, London, Royal Medals have been awarded to Dr. Francis William Aston, F.R.S., in recognition of his discovery of the isotopes of non-radioactive elements, and to Professor Ronald Aylmer Fisher, F.R.S., in recognition of his contributions to the theory and practice of statistical methods.

ACCORDING to the *Bulletin* of the American Society for Testing Materials, L. F. Rader, associate professor of civil engineering at the Polytechnic Institute of Brooklyn, N. Y., has been awarded the prize of Belgium in a competition sponsored by the Permanent International Association of Road Congresses. This prize was founded by the Government of Belgium and is awarded at meetings of the congress to the author of the most striking paper submitted containing suggestions for promoting progress in construction, maintenance and exploitation of roads and for facilitating traffic. Dr. Rader's paper gave the results of investigations of the physical properties of asphalt pavements at low temperature.

THE Roebling Medal of the Mineralogical Society of America will be presented to Dr. Waldemar T.

Schaller, of the U. S. Geological Survey, at the annual meeting of the society to be held at the Waldorf-Astoria Hotel in New York City from December 28 to 30. Dr. Schaller is the second recipient of the medal.

DR. F. M. WHITACRE, assistant professor of organic chemistry at the Case School of Applied Science, was awarded the medal of the International College of Anesthetists at the annual meeting held in New York City on October 19. The award, which was made in recognition of his work on the chemical structure of anesthetics, consisted of a medal and a certificate naming Dr. Whitacre as a specialist in anesthesia and a fellow in the International College of Anesthetists.

AT the annual meeting of the National Society for the Prevention of Blindness, the Leslie Dana Gold Medal was presented to Dr. Ellice M. Alger, of New York City. This honor is given each year for "outstanding achievements in the prevention of blindness and the conservation of vision." The presentation was made by Dr. John N. Evans, of Brooklyn, on behalf of the Association for Research in Ophthalmology and of the St. Louis Society for the Blind. Dr. Alger and Lewis H. Carries, managing director of the National Society for the Prevention of Blindness, were the principal speakers.

DR. VANNEVAR BUSH, president-elect of the Carnegie Institution of Washington, D. C., will be the guest of honor on January 13 at the "All Engineers Dinner" given at the annual assembly of the American Engineering Council, which will be held in Washington on January 12, 13 and 14.

DR. F. J. SEAVER, of the New York Botanical Garden, has been elected an honorary member of the California Mycological Society.

DR. MORTIMER E. COOLEY, dean emeritus of the Colleges of Engineering and Architecture of the University of Michigan, has been elected a fellow of the Royal Society for the Encouragement of Arts, Manufactures and Commerce.

DONALD B. GILLIES, vice-president of the Republic Steel Corporation, has been elected president of the American Institute of Mining and Metallurgical Engineers. Four new directors have been chosen, as follows: Charles Camsell, Deputy Minister of Mines for Canada, Ottawa; Charles H. Fulton, president of the Southern Phosphate Company, Baltimore; John T. MacKenzie, chairman of the iron and steel division of the American Institute of Mining and Metallurgical Engineers, metallurgist and chief chemist of the American Cast Iron Pipe Company, Birmingham, Ala., and Dr. Francis A. Thompson, president of the Montana School of Mines, Butte, and chairman of the institute's mineral education division.

PROFESSOR KIRTLEY F. MATHER, professor of geology at Harvard University, who has been director of the Harvard Summer School since 1934, has been elected president of the Association of Summer School Deans and Directors.

DR. L. J. SPENCER was elected president of the British Mineralogical Society and editor of the *Journal* at the anniversary meeting of the society held on November 3.

DR. WILLIAM D. MERRELL, professor of botany since 1899 and member of the faculty at the University of Rochester, has been granted a year's leave of absence. He will retire from active service and will become emeritus professor in June, 1939.

DR. JOHN H. WHITTEN, of the Chicago Teachers College, has retired after serving for twenty-four years in the department of botany. The vacancy caused by his retirement has been filled by the appointment of Dr. Howard J. Dittmer, recently of the State University of Iowa.

DR. JOSEPH A. FREIBERG, associate professor, will succeed his father, Dr. Albert H. Freiberg, as head of the department of orthopedic surgery of the College of Medicine of the University of Cincinnati. The elder Dr. Freiberg resigned in July after forty years of service. Since then his son has been acting head.

AT the College of Arts and Pure Science of New York University, Dr. William H. Crew, of the United States Naval Academy Post-Graduate School, has been appointed chairman of the department of physics, and Dr. Ernest R. Lilley has been made director of the Geological Museum at University Heights. Dr. Edward R. Maloney, dermatologist, and Dr. Clarence E. de la Chapelle, heart specialist, have been advanced to full professorships in the College of Medicine.

THE following changes have been made in the faculty of chemistry of the Ohio State University: Dr. Albert L. Henne, formerly of the Midgley Foundation, has been elected to an associate professorship. Professor Henne will be associated with Professor C. E. Boord in the supervision and direction of the recently established Pure Hydrocarbon Research project of the American Petroleum Institute. Grant Crane (Dartmouth, '37) and Amos Turk (College of the City of New York, '37) have been elected to fellowships in this work. Through the establishment of a cooperative research plan between the Charles F. Kettering Foundation of Antioch College and the department of chemistry of the Ohio State University, Associate Professor Paul Rothemund, of Antioch College, has been elected non-resident associate professor in the faculty of chemistry of the university. John W. Van Cleve (Antioch College, '37), Amel Menotti (Antioch Col-

lege, '37) and T. E. Londergan (Antioch College, '36) have been elected to Kettering Foundation fellowships with their research residence at Antioch College.

A CORRESPONDENT writes that the number of *Vita Universitaria* for October 5 contains a list of a hundred professors in Italy, eighty-five of whom were full professors, who were dismissed from their chairs as of October 16. The list includes: Bologna, Mario Camis; Genoa, Ugo Lombroso, and Milan, Carlo Foa, all professors of human physiology; Padua, Bruno Rossi, professor of experimental physics, and Tullio Terni, past fellow, professor of normal human anatomy; Palermo, Camillo Artom, professor of human physiology, and Emilio Segre, past fellow of experimental physics; Rome, Federigo Enriques, professor of higher geometry, and Tullio Levi Civita, professor of rational mechanics; Turin, Amedeo Herlitzka, professor of human physiology, and Giuseppe Levi, professor of normal human anatomy.

ACCORDING to the *Journal* of the American Medical Association a scientific advisory council has been appointed for the Children's Hospital Research Foundation at Cincinnati, Ohio. The council consists of Drs. Oswald T. Avery, of the Rockefeller Institute for Medical Research, New York; Ernest W. Goodpasture, professor of pathology, Vanderbilt University School of Medicine, Nashville, Tenn.; Albert Baird Hastings, professor of biological chemistry, Harvard University Medical School, and Alfred N. Richards, professor of pharmacology, University of Pennsylvania School of Medicine. The Children's Hospital Research Foundation was established in 1929 with funds given by Mr. William Cooper Procter. The hospital and the foundation are affiliated with the University of Cincinnati College of Medicine. Dr. Albert Graeme Mitchell, professor of pediatrics, is director of the medical service of the hospital and of the foundation. Dr. Glenn E. Cullen is director of laboratories.

DR. ARTHUR H. COMPTON, professor of physics at the University of Chicago, was inducted as Protestant co-chairman of the National Conference of Jews and Christians at a dinner of the New York Round Table of the conference on November 28 at the Hotel Astor, New York City. Dr. Compton succeeds the late Newton D. Baker as co-chairman. A bound volume of felicitations from more than three hundred American leaders was presented to him. Speakers at the dinner included: Lieut.-Governor-elect Charles Poletti; President Henry Noble MacCracken, of Vassar College; Matthew Woll, vice-president of the American Federation of Labor; Professor Harold C. Urey, of Columbia University, and Dr. Abraham Flexner, director of the Institute for Advanced Study, Princeton, N. J.

THE U. S. Bureau of Biological Survey has opened regional headquarters in Boston. Offices have been established in the Park Square Building with S. Barron Locke in charge as regional director. His jurisdiction will cover ten states, including New England, New York, Pennsylvania, New Jersey and Delaware. Bertram G. Smith, formerly in the office at Portland, has been appointed administrative assistant.

DR. PAUL C. BARTON, of Chicago, since 1934 a member of the staff of the Council on Pharmacy and Chemistry, has been appointed director of the Bureau of Investigation of the American Medical Association.

Nature states that Dr. T. S. Wheeler, principal of the Royal Institute of Science, Bombay, has left India and will shortly take up his new appointment as state chemist in Eire.

DR. J. A. VON MONROY, of Berlin, chief forester of Germany, is visiting the United States.

DR. CARL J. WIGGERS, professor of physiology of the School of Medicine of Western Reserve University, who left on September 9 for a lecture trip to South America, has returned to Cleveland. He sailed through the Panama Canal down the West Coast of South America, visiting Callao, Peru, Arica, Valparaiso and Santiago, Chile. Thence he flew over the Andes to Buenos Aires. In Argentina he was the guest of Professor B. A. Houssay, of the University of Buenos Aires, and of Professor Oscar Orias, of Santa Rosa, a former student in Cleveland. Dr. Wiggers delivered a series of lectures in Spanish on "The Applications of Physiology to Medicine" in Buenos Aires, Santa Rosa, Rosario and Cordoba.

A SERIES of Lowell lectures is being given in Boston by Dr. Arthur H. Compton, professor of physics at the University of Chicago, on "The Structure of the Physical World."

DR. W. F. G. SWANN, director of the Bartol Research Foundation, Swarthmore, Pa., spoke at the Industrial Science Banquet of the Iowa State College on November 22. His subject was "The Science of Yesterday, To-day and To-morrow."

DR. FRANK B. JEWETT, president of the Bell Telephone Laboratories, New York City, will speak at Rockford College on February 18 under the auspices of the William Arthur Maddox Foundation.

AT the annual meeting in Washington, D. C., of the American Society of Agronomy, which was held on November 16, 17 and 18, officers were elected for next year as follows: Dr. Ralph J. Garber, Bureau of Plant Industry, *president;* Dr. F. J. Alway, University of Minnesota, *vice-president;* Dr. W. A. Albrecht, University of Missouri, *chairman of the Soils Section;* Dr. F. D. Keim, University of Nebraska, *chairman of*

the Crops Section; Professor J. D. Luckett, New York Agricultural Experiment Station, *editor;* and Dr. G. G. Pohlman, University of West Virginia, *secretary-treasurer.* Dr. R. J. Garber, Bureau of Plant Industry, and Dr. F. B. Smith, University of Florida, were elected to represent the society on the council of the American Association for the Advancement of Science in 1939. Officers of the Soil Science Society of America elected for next year are: Dr. W. A. Albrecht, University of Missouri, *president;* Dr. W. H. Pierre, Iowa State College, *secretary,* and Dr. G. G. Pohlman, University of West Virginia, *treasurer.*

THE third annual meeting of the Carolina Geological Society was held on November 12 and 13 with thirty-five members and twenty-six visitors in attendance. The meeting was held at the University of South Carolina. On November 12, there was a field trip of some 117 miles with twelve stops to examine the local geology about Columbia, S. C., both in the coastal plain and the Piedmont. The University of South Carolina gave the members a complimentary dinner. On November 13, there was an additional field trip of some 78 miles with five stops including the Haile Gold Mine near Kershaw, where refreshments were served. The field trips were arranged and directed by Professors Taber, Smith and Petty, of the University of South Carolina. The following officers were elected for the coming year: *President,* Professor L. L. Smith, University of South Carolina; *Vice-president,* Professor J. H. Watkins, The Citadel, Charleston, S. C.; *Secretary and Treasurer,* Professor Edward Willard Berry, Duke University; *Chairman of Membership Committee,* Professor Raymond Binford, Guilford College, N. C.

THE U. S. Civil Service Commission announces that the Department of Agriculture is in need of a number of principal chemists and principal chemical engineers at salaries of $5,600 a year. It is expected that the number will exceed twenty-five. Dr. Henry G. Knight, chief of the Bureau of Chemistry and Soils, suggests that all persons interested in these examinations communicate at once with the Civil Service Commission, Washington, D. C., in regard to the announcement containing the detailed information concerning the technical qualifications required. He urges all chemists having the technical qualifications to apply for this examination. Applicants will not be required to report for examination but will be rated on education, training and experience as shown on their applications. There is no obligation involved in taking the examination, although in view of the need for qualified persons it is hoped that it will be possible for an applicant to accept a position should one be tendered him. The list of eligibles from these examinations will be used for the appointment of project leaders in the four regional research laboratories being set up by the Department of Agriculture in accordance with an act of the last Congress. Work in the laboratories, each of which has an appropriation of a million dollars a year, will be based on the major farm commodities in the neighborhood of the laboratory.

THE St. Anthony Falls Hydraulic Laboratory of the University of Minnesota was dedicated on November 17. Dr. Guy Stanton Ford, the newly elected president of the university, presided. Among the speakers were Dr. S. C. Lind, dean of the Institute of Technology, and Corrington Gill, assistant administrator of the Works Progress Administration, Washington, D. C.

ADDITIONS to the present facilities of the Engineering Building at Rutgers University will increase the laboratory space available for engineering students by 6,242 square feet or about 57 per cent. The work will be started shortly and will be financed jointly by the university and the Works Progress Administration, which recently approved a grant of $34,576 for the project. The additions and alterations consist of two parts, one of which will provide for the construction of a new wing in the rear of the present building, and the other for reenforcing the floor over the swimming pool in the present Ballantine Building. This pool is the only unit remaining from the old Ballantine Gymnasium, which was destroyed by fire in 1930. The pool has been used by the department of engineering as a hydraulics laboratory since the present Ballantine Building was completed in 1932.

DISCUSSION

BEAVER-DAMS AS GEOLOGIC AGENTS

IN the mapping of the Schuylerville, Cohoes and Troy quadrangles of the Capital District and more recently of the Catskill quadrangle, the senior author had occasion to observe various broad and flat alluvial plains, affording rich farm-land, that in size are completely out of proportion to the small brooks that drain them at present. A typical case is the long, perfectly leveled valley east of Troy at the foot of the Rensselaer plateau, extending nine miles north and south and one-fourth to one-half mile wide. The origin of this partly "dead valley" is undoubtedly from glacial meltwater, as indicated by traces of terraces on the banks; but now it is drained by four different creeks, the Tomhannock, flowing north, the Quackenkill, flowing south, the Poestenkill, crossing it obliquely in the middle, and

the Newfoundland creek, coming into it from the south. Another characteristic case is the Stony Creek alluvial plain, east of Madelin, near the southern margin of the Catskill quadrangle. This broad plain is 4 miles long and one-half to two miles wide and drained by creeks much too small to produce such a broad plain.

These alluvial plains are currently considered as post-glacial lake bottoms, but Mr. J. H. Cook, who has written the glacial chapters of the State Museum bulletins published by the senior author, has insisted that they were formed by brooks merely meandering over the plains and has given as proof that these plains are distinctly graded and descend with the brooks, a condition that seems irreconcilable with the lake origin. This is quite notable in the Stony Creek alluvial plain, where, according to the new topographic map now being published, the upper end is at 216 feet A. T. and the outlet at 164 feet. This would seem to exclude a former lake bottom, except when a slowly subsiding lake is assumed, which again fails to be supported by the presence of low terraces, and in the Troy valley the drainage running in opposite directions is distinctly hostile to such a view. Neither could have merely meandering brooks been able to produce the continuous Troy valley, independent from the direction of the brooks.

For these reasons the senior author came to the conviction that a third agent had to be found and this is seen in the beavers who, by building dams successively upward from the lower reaches to the very sources of the creeks and repeating this process as often as the ponds are filled by sediment and carrying on the cycles of wandering up the creeks with dam-building for untold thousands of years (25,000 years are available in post-glacial time!), must have accomplished an enormous amount of aggrading work in the course of time in the northern half of North America. And if the giant beaver *Castoroides ohioensis,* of the size of a black bear, was also given to dam-building, which is not proven, even smaller river valleys could have been graded by its influence.

It is significant that the older settlers in parts of New York, as around the Tug Hill plateau (*fide* Dr. D. H. Newland) still know these alluvial valleys as "beaver-meadows."

Geologists apparently have overlooked this important geologic agent, a fact which is illustrated by the omission of the beavers as physiographic factors in Nevin M. Fenneman's authoritative "Physiography of Eastern United States," just published (McGraw-Hill Book Company, 1938).

The ceaseless activity of the beavers became very impressive to the senior author when he saw this summer how they, when driven by a flood from their dam below Cranberry Lake in Rensselaer County, repaired that dam and at once built a second above and started still a third dam a little farther up for the protection of the second. This wonderful industry is fully appreciated by the United States Government, as recently reported by the press; for it has set between 500 and 600 beavers to work in the northwest, notably Idaho, but also in Oregon, Washington, Utah and Wyoming, to stop erosion in brooks and creeks by importing beavers from regions where they are not needed, to the fast eroding waters and building there small provisory dams by CCC workers. The beavers as loyal government officials promptly complete work valued at $300 for each at a cost of $5.00 per head, according to a report by Mr. Ickes.

The junior author, who as assistant state zoologist has for many years studied the fascinating habits of the beavers in Rensselaer County, has undertaken to gather the following data on the present aggrading activities of the beavers in eastern New York. These data not only seem to illustrate the rapid work of the beavers, but above all the great width and height of the dams beavers can build on occasion and the size of the ponds they can form.

It seems reasonable to first consider the possible number of beavers that have inhabited the country and judging from such remains as beaver meadows and evidences of dams, it seems that every lake, pond, river and brook in New York State was occupied by this industrious rodent. Radford estimates that in the days of Champlain, the beavers in what is now New York State numbered probably several million and states that according to an old Dutch writer the Province of New Netherlands furnished eighty thousand beaver skins in the year 1671.

The next consideration might be the size of the dams and the area of the ponds. Mills records a Montana beaver dam that was 2,140 feet long. This, however, is extreme, and the junior author has found dams of fifty to two hundred feet to be more common and a six hundred-foot dam to be exceptional. Shiras writes that the left bank of what is now Echo Lake on Grand Island in Lake Superior is an ancient beaver dam 1,500 feet long and probably 400 years old. The dam which makes Beaver Lake in Yellowstone Park is about 700 feet long, and two dams described by Morgan are 488 and 551 feet in length.

The height of the dam is usually five or six feet, although the long Montana dam recorded by Mills was in two short sections, fourteen feet high, and Morgan described a dam 35 feet long and 12 feet in vertical height.

The bodies of water impounded by these dams vary in size. Warren reports that a 103-foot dam formed a pond 225 by 350 feet and a 165-foot dam flooded an

area 340 by 800 feet. Three dams, 35, 50 and 60 feet long, respectively, formed ponds 350, 375 and 475 feet in length.

A dam 75 feet long is reported by Johnson to have backed up a mile of water, and Houk records 1,241 acre-feet of water impounded by beaver dams in the San Luis Valley, Colorado.

The number of dams on a stream is also an important factor in determining the size and shape of the beaver meadow and to locate six dams on a mile of stream is not uncommon. In fact, according to Houk, in Silver Creek Valley in Colorado there were 46 dams located on 5¾ miles of stream, and these averaged about 660 feet apart. In some cases the water was backed up to a depth of five and one-half feet.

So long as the beavers occupy the ponds no beaver meadows are formed, but as soon as the ponds are made the silt begins to settle in and fills them, and this forces the animals to continue to raise the dam. When the rodents abandon the pond, however, a meadow may be formed in a very short time.

In 1897 Seton mapped and described some ponds on Lost Creek in Yellowstone Park which were inhabited by a colony of beavers. These animals began to desert the area in 1903 or 1904, and in 1912 when Seton revisited the site the colony was abandoned and the meadows were pretty well formed. In 1921 the ground was solid and the dams practically obliterated. It is evident then that a meadow can be formed in about 15 years.

Conclusions

The authors, from the data presented here, conclude that beavers are able to aggrade all smaller valleys below the size of navigable rivers and having been active for many thousands of years have accomplished an enormous amount of aggrading work and are important physiographic agents. Their work is characterized by complete aggrading of valley floors, originally in small descending steps, which disappear in time and leave a gently graded, even valley plain horizontal from bank to bank. The fine silt gathered in the beaver pools has produced the rich farm land in the valleys of the wooded areas of the northern half of North America.

Rudolf Ruedemann
W. J. Schoonmaker

New York State Museum

THE MOVEMENT OF WATER FROM CONCENTRATED TO DILUTE SOLUTIONS THROUGH LIQUID MEMBRANES

An experiment by W. J. V. Osterhout and J. W. Murray was described under the above title in the issue of May 13 of Science, page 430. To quote, "In certain models set up to imitate living cells the behavior of water is the opposite of what is expected, for it moves from a concentrated to a dilute solution or from a region of low to one of high activity. This apparent violation of the laws of thermodynamics may continue for months before equilibrium is attained." Briefly, this experiment consisted in using guaiacol (o-methoxy-phenol) as a membrane in the bottom of a U tube and placing water on one side and a solution of acetic acid in water on the other side. The water moves from the acetic acid to the pure water side.

In attempting to discover a possible thermodynamic explanation for the above experiment or to show that a thermodynamic explanation does not apply we have performed the following experiments. The freezing point of guaiacol was determined and the lowering in the freezing point was determined when water or acetic acid was added and finally when both were added simultaneously. It is found that water and acetic acid produce the same lowering of the freezing point when equal numbers of moles are added. This first experiment was not too conclusive, since the solubility of water is small in guaiacol. Three hundredths of a cubic centimeter of water was added to 50 cc of guaiacol. In the next experiment a large amount of acetic acid, 1 cc, was added to 50 cc of guaiacol, producing a lowering of 2.49 degrees. Addition of water to this solution in 0.1 cc quantities gave only one fourth the lowering which one would have predicted from the number of moles added. In this experiment there is no difficulty from small solubility, as water is quite soluble in this solution.

One may draw the conclusion from these experiments that the water and acetic acid are associated in the guaiacol solution. The fact that the water produces some lowering in the freezing point may indicate that the association is not complete or that acetic acid is associated by itself in guaiacol, and the addition of water increases the dissociation of double acetic acid molecules.

An explanation for at least part of the anomalous diffusion of water in the experiment of Osterhout and Murray may be as follows. Water and acetic acid are associated in water solution. This attracts no attention ordinarily, since the water is the solvent, but may be inferred from the fact that acetic acid, which exists associated as double molecules in the gas phase, exists as single molecules in water solution. The solute which is diffusing through the guaiacol is, therefore, this rather stable pair, which has been shown from the above freezing points to exist in the guaiacol solution. The diffusion of this pair is then a typical case of osmosis, except for the fact that the solvent is very

slightly soluble in the membrane and the solute does the diffusing, from a region where its concentration is high to one in which its concentration is low.

This explanation serves to amplify the explanation given by Osterhout and Murray, who say that the phenomenon is due to the fact that the "acid increases the solubility of water in the guaiacol phase," indicates the way in which this increased solubility is brought about, does away with the apparent violation of the laws of thermodynamics, and suggests possible limitations in the applications of this model to biological phenomena.

HENRY E. BENT

UNIVERSITY OF MISSOURI

NATION-WIDE JUNIOR SCIENCE CLUBS

THE scientific attitude and scientific investigation have their beginnings in the lower grades of our secondary schools. Evidence of this appears in the desire of junior-high-school and high-school students to take part in scientific activities outside of regular school hours. The natural desire is to join a science club. Many of these science clubs are to-day well endowed in both leadership and facilities with which to work, so that they often make definite contributions to science. However, even before they finish their introductory work in science, secondary school students are being called upon to realize the application of scientific principles to every-day events, and to understand the position which science plays in the development of modern society.

During the past ten years, the American Institute of the City of New York has fostered the organization of its science clubs. This is a natural outgrowth of its efforts to relate science with society since 1828. Now, under the name of the American Institute Science and Engineering Clubs, it announces the expansion of its science clubs on a nation-wide basis to coordinate the scientific pursuits of American youth.

As a first step, the best youth organizations in the country have endorsed the plans. Already, educators everywhere are agreed that science is a natural and practical medium by means of which to stimulate and guide the thinking of young people. On October twenty-first, an introductory announcement of the new organization was sent to educators and their institutions, scientists, engineers and youth leaders, suggesting that they be sponsors of the clubs. This announcement presented the reasons for forming science clubs and explained how the American Institute Science and Engineering Clubs could perform the function of organizing existing and future clubs into one unit. The institute will supply upon request from these sponsors authoritative bulletins on "How to Organize a Science and Engineering Club," "How to Organize a Science Congress," "How to Equip a Science Techniques Shop" and "How to Interest a Community in Science Club Work."

As a unifying influence and also as a clearing house of science news for youth throughout the country, the American Institute will publish monthly its own science newspaper, called *The Science Observer*. This journal will carry columns devoted to club activities, youth research projects and up-to-date news in science. A pictorial section will be a feature of the publication.

The present program of the institute clubs calls for its annual science congress on December 29, at which the well-known Christmas lectures will be presented.

In March the annual science fair will be held in the American Museum of Natural History. To this come some of the most significant products of the scientific activities of the clubs and individual students. Four groups of exhibits designed to relate science with modern life are presented: Transportation, communication, production and public welfare are each a class under the engineering group. Plants and animals, medicine and biochemistry, heredity and evolution form the biological sciences. In the third group, the physical sciences, such as geology, astronomy and pure physics and chemistry, are represented. Of great interest will be the leisure-time activities exhibits of the fourth group. Prizes to a total of $3,000 are awarded to scores of exhibits at the fair.

Through the medium of traveling organizers, a speakers bureau and eventually short-wave radio, the work of the institute clubs will be organized as one national unit. Sponsors and other interested leaders may receive full information by writing to the American Institute, 60 East 42nd St., New York City.

C. A. FEDERER, JR.

OPPOSITION TO AN INTERNATIONAL CONGRESS OF PSYCHOLOGY IN VIENNA

WHEN the twelfth International Congress of Psychology, to be held in 1941, was awarded to Vienna, it was not supposed that within a few months Austria was to be annexed to Nazi Germany. The *Anschluss* took place on March 11, 1938. The reaction among American psychologists was immediate and unequivocal.

Six weeks after the *Anschluss* of Austria there occurred the annual meeting of the Midwestern Psychological Association at the University of Wisconsin on April 22. Resolutions were adopted after considerable discussion urging the removal of the 1941 congress away from Austria, because "Germany is now governed by a Nazi dictatorship, which has subordinated the integrity of science and of scientists to

a political creed, which has caused the dismissal of many scientists and scholars from their positions, which has caused the emigration of many of the nation's outstanding scholars to other countries, and which has so injured German psychology that it no longer holds the eminent position it once did," and because "the attendance of the world's psychologists at an International Congress in Vienna could be interpreted at best as a lack of opposition to, and at worst an endorsement of Nazi treatment of science and of scientists."[1]

The Western Psychological Association, meeting at the University of Oregon on June 18, passed almost unanimously a resolution on the grounds that "psychology in Germany is no longer scientifically reputable." The Rocky Mountain Branch of the American Psychological Association followed with a resolution passed unanimously at its annual meeting at the University of Colorado on July 23, stating that "Austria is now ruled by a government whose philosophy is opposed to the free pursuit of science and whose treatment of many scientists has been uncivilized."

Three local psychological societies, in mail referenda of their membership, passed similar resolutions by majorities ranging from 89 per cent. to 100 per cent. The Chicago Psychological Club stated that "present-day conditions in Austria—restrictions on the freedom of teaching, speech, press and assembly; persecution of certain racial, religious and social groups; and stifling of the spirit of scientific inquiry—render many psychologists unable and unwilling to attend a . . . Congress of Psychology . . . scheduled to meet in Vienna. . . ." The Illinois Society of Consulting Psychologists requested that the congress "be convened in a location where every psychologist or guest, regardless of his ancestry, religious creed or political belief, may attend without fear of interference in his proper enjoyment of the Congress." The Psychologists League of New York City charged that the annexation of Vienna by the Nazi Reich "has produced in that city a reign of terror . . . with the connivance of the new governmental régime, and has . . . introduced . . . a situation that has long prevailed in Germany itself, where the free development of scientific psychology has been rendered impossible because, on the one hand, there has been official government support for patently unsound psychological theories that fit the political ideology of the existing régime, and, on the other hand, many individual psychologists of recognized probity have been driven into exile because they were Jewish or partly Jewish in ancestry or because they hold liberal political views, and that it is unthinkable that the decision to hold the Congress in Vienna could have been taken if it had been known that such a condition would prevail, since it is clearly impossible to have a true Congress of Psychology in a country that has driven into exile so many of the world's foremost psychologists, of whose scientific achievements any country might well be proud."

During September the American Psychological Association, together with three affiliated psychological societies, held annual meetings at the Ohio State University. The American Association for Applied Psychology, after receiving the council's report that "the council accepts the view that the association should take no action on purely political grounds but recognized that scientific work (even when of the purest research character) may have political reverberations and that political changes may have momentous effects on both pure and applied science. The association can not ignore the destructive influence of Nazi politics on all science, including our own. For the International Congress to meet in Vienna would be to take *political* action—political action favorable to anti-scientific forces. Psychologists in America, relatively remote from Nazi influences, have the duty to take the lead in withdrawing the Congress from its Vienna meeting place," passed unanimously the recommended resolution requesting a change of meeting place from Vienna, since "conditions have become unfavorable to the holding in that city of a scientific congress." The Society for the Psychological Study of Social Issues passed unanimously a resolution declaring that "many distinguished exiled psychologists would be unable safely to re-enter Nazi territory even for attendance at a scientific meeting" and that the actions of the Fascist dictatorship "violate the highest ideals of science." In the Psychometric Society, however, the council recommended that no action be taken on the ground that this matter did not concern the objective of the society, which is the "development of psychology as a quantitative rational science." A motion requesting removal of the congress from Vienna was subsequently laid on the table by a majority vote of the membership.

In the American Psychological Association, comprising about 2,500 psychologists, the following resolution as recommended by the council was received with applause by the membership and passed without dissenting vote: *"Be it resolved* that the American Psychological Association request the Committee in charge of arrangements for the XIIth International Congress of Psychology to terminate, if it has not already done so, the tentative plan to hold this congress in Vienna in 1941; and that it requests the committee to arrange for the congress in some country where the progress of psychology as a branch of science is not hindered by a government hostile to the tradition of free and unimpeded scholarship."

[1] See SCIENCE, 87: 479, 1938.

Since the above-mentioned meetings of American psychologists it has been learned that the Council of the British Psychological Society has unanimously recommended the 1941 meeting of the congress be not held in Vienna.

The International Committee is comprised of 69 psychologists from all parts of the world. The executive committee is as follows: Edouard Claparède, of the University of Geneva, *permanent secretary;* Herbert S. Langfeld, of Princeton University, *secretary;* C. S. Myers, of the National Institute of Industrial Psychology, London, Henri Pieron, of the University of Paris, Mario Ponzo, of Rome, E. Rubin, of the University of Copenhagen, and Emilio Mira, of Barcelona, *members.*

CORRESPONDENT

SCIENTIFIC BOOKS

RESPIRATION

Adventures in Respiration. Modes of Asphyxiation and Methods of Resuscitation. By YANDELL HENDERSON. The Williams and Wilkins Company, Baltimore, Md. Pp. xi + 316, frontispiece, 15 figs. in text. June, 1938. $3.00.

IN 1905 Haldane and Priestley published a noteworthy paper on lung ventilation, ending with the well-known conclusion that "the regulation of the rate of alveolar ventilation in breathing depends, under normal conditions, exclusively on the CO_2 pressure in the respiratory center." These words had great weight with a young assistant professor of physiology in the Yale Medical School who was teaching his students that respiration is chiefly controlled by the vagus nerves and is relatively little influenced by oxygen or CO_2. The young man, Yandell Henderson, constituted himself "as an active propagandist for the Haldane doctrine, confident that the conception of CO_2 as a factor in the control of respiration must lead to a recognition of a similar part in the control of other functions as well, and particularly of the circulation."

During the next 15 years numerous papers came from the author's laboratory dealing with shock, respiratory regulation of the CO_2 capacity of the blood and hemato-respiratory functions. In "Adventures in Respiration" some attention is paid to venous return in relation to muscle tonus, but the principal thesis of the book and of the investigations just mentioned is that acapnia, or inadequate pulmonary ventilation, "is a factor in the depression of vitality after anesthesia, surgical operations, physical injuries and severe illness."

The 15-year campaign to win from fellow physiologists approval of his thesis of acapnia by laboratory experiment and theoretical discussions failed. We now know that in many respects Yandell Henderson was right and his critics wrong. In other respects, however, he was wrong, and the proof of his error was in some instances so convincing that the experimental foundations of his thesis were shaken.

At the end of the first campaign he shifted his attack to a front on which there had been but desultory firing. In 1909, before a distinguished gathering at Johns Hopkins, he had stated that administering 5 per cent. CO_2 in air or oxygen benefited apneic anesthetized animals. He suggested that medicine might advantageously adopt such mixtures for treating anoxial acidosis and he proposed that manufacturers prepare mixtures in cylinders for this purpose. This proposal brought such a devastating criticism from a distinguished professor of physiology in the audience that the speaker was left speechless; instead of a rebuttal, he offered good-humoredly to meet his critic outside.

In beginning his second 15-year campaign, Yandell Henderson decided to brush aside theoretical objections and to return to the attack on this neglected front. Here he very skilfully achieved victory. "Adventures in Respiration" records his success in persuading surgeons to provide their anesthetists with the CO_2-oxygen mixture, in teaching clinicians to use it in pneumonia, obstetricians in childbirth, and first-aid crews in resuscitation from carbon monoxide poisoning. The most dramatic success achieved has been in the treatment of carbon monoxide poisoning. An essential element in this is the H.H. inhalator designed by the author during the war and developed by the Mine Safety Appliances Company. It is estimated that the administration of CO_2-oxygen mixtures by means of this device saves annually more than 10,000 lives from carbon monoxide asphyxia in America alone. The treatment is also used abroad; it is officially sanctioned by the Mines Department of the British government.

Although brought up a physiological chemist, the author turns his back on biochemists. Their currently accepted idea of acid-base balance adds to his difficulty, and he finds a clear passage, "by steering contrary to their directions. . . . At critical points their latitude and longitude are erroneous, and even the points of the compass are reversed." While many will find other interpretations for his unhappy experience in attempting to follow the sailing directions of biochemists, none will dispute the eloquent confirmation he has given to the wise conclusion of Miescher that, "Over the oxygen supply of the body carbon dioxide spreads its protecting wings."

D. B. DILL

ATOMIC PHYSICS

An Outline of Atomic Physics. By O. H. BLACKWOOD, E. HUTCHISSON, T. H. OSGOOD, A. E. RUARK, W. N. ST. PETER, G. A. SCOTT, A. G. WORTHING; second edition, pages ix + 414, John Wiley and Sons, Inc., New York; Chapman and Hall, Ltd., London, 1937.

THIS volume, written by the members of the physics staff of the University of Pittsburgh, is designed as a text-book for those students who have completed one year of college physics and who, although desiring more knowledge of the subject, do not intend to specialize in it. The authors endeavor to acquaint the student with those branches of physics in which active progress is being made to-day, and to provide, at the same time, sufficient background to enable him to appreciate the significance of the more recent discoveries.

After a discussion of the atomic nature of matter and electricity, black-body radiation and the photo-electric effect are described to show the atomic nature of radiation. Then follow chapters dealing with the structure of atoms and molecules and their spectra. In this section there is attempted a reconciliation, or rather fusion, of the wave-like and corpuscular properties of matter and radiation by means of an introduction to wave mechanics and a discussion of the uncertainty principle. Although there are a number of points which might be criticized in this section, the degree of sophistication adopted is consistent with the remainder of the book, and is a very useful one.

There follow two chapters on nuclear physics, the first of which describes the natural radioactive elements and the properties of their radiations. The second chapter, which has been added in the second edition, contains an account of the discovery and properties of the neutron and the positive electron, the methods of producing charged particles of high energy and a survey of the artificial transmutations effected with them. Unfortunately, the chapter was written too soon to include any discussion of the concept of a compound nucleus, and no hint is given as to the origin of nuclear forces. Included also in this chapter are about twenty pages devoted to cosmic radiation. Here again the fact that the text antedates the discovery of heavy electrons somewhat mars the usefulness of the section.

The book is concluded by chapters on the theory of relativity and a long and very interesting survey of astrophysics. It is regrettable that physicists as a whole do not pay more attention to this important and fruitful field. The inclusion of it in this book is to be much commended. A surprisingly large amount of material is covered in this volume in a simple and straightforward manner. The style is remarkably uniform, considering the number of authors collaborating. The book should well serve the most useful function for which it was designed.

C. G. MONTGOMERY

BARTOL RESEARCH FOUNDATION OF THE FRANKLIN INSTITUTE, SWARTHMORE, PA.

THE MATHEMATICAL THEORY OF ELECTRICITY

Lectures on the Mathematical Theory of Electricity. By F. B. PIDDUCK. Oxford, The Clarendon Press, 1937. viii + 110 pp. $3.25.

THIS book is a series of fragmentary notes of a course of lectures which were themselves designed to supplement systematic reading by the student. It was evidently the author's chief aim to present in these lectures examples illustrating the application of certain formulae and methods of the theory to the solution of specific problems. Thus such problems as electrostatic shielding by plane and cylindrical grids, the space charge effect in thermionic vacuum tubes, the Aston mass spectrograph, the triod oscillator and the propagation of electromagnetic waves along wires are treated in adequate detail.

The book is of secondary value to an institutional reference library and may contain suggestive material useful to a teacher of the subject.

S. L. QUIMBY

COLUMBIA UNIVERSITY

STUDIES ON PTERIDOPHYTES

Manual of Pteridology. Edited by FR. VERDOORN. 640 pp., with 121 figures. Martinus Nijhoff, The Hague, 1938. Price, 24 guilders.

ACCORDING to its editor, "This book is primarily, but by no means exclusively, designed for the taxonomist who is anxious to improve his methods and broaden his outlook. At the same time it offers to the general botanist working on the Pteridophytes the necessary fundamental facts about the group, and a survey of the chief results of lines of investigation related to his own. . . . This manual is not, and never could be, an exhaustive monograph, it is rather a collection of essays. The editor has always urged his contributors to give more space to new ideas than to an academic summary of established knowledge. . . ."

The work comprises 23 chapters, covering a wide range of topics, some in English and some in German, written by the leading authorities on Pteridophytes. These essays furnish valuable summaries of the literature and discussions of the present state of our knowledge in the respective fields. Controversial subjects like the nature of the base of *Isoetes,* the tactic movements of spermatozoids and the phylogenetic relations between Bryophytes and Pteridophytes receive full and fair treatment. Especially noteworthy is a new classification of the *Filicinae* put forward by Christensen, on the basis of recent work on morphology.

Editing has been carefully done, and few misprints have escaped correction. Ample illustrations are included, and the printing and binding of the book are of high quality. Every institution where botanical research is carried on will need a copy in its library.

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SPECIAL ARTICLES

VENEZUELAN EQUINE ENCEPHALOMYELITIS

As is well known, severe epidemics of equine encephalomyelitis have occurred this year in Canada and the United States. A similar disease has now broken out in northern South America. Through the courtesy of the Ministry of Agriculture of the Venezuelan government and of Dr. Gunnar Tryde, of Caracas, we have received portions of brains of animals dying of this disease.

Virus has been recovered from these brains and preliminary observations have been made on the disease it produces in guinea pigs, mice and chicken embryos. The symptoms resemble those of Eastern encephalomyelitis. Nevertheless, it is clear that this virus is significantly different from either of the known American strains. Guinea pigs receiving it intracerebrally show first signs of paralysis after about 48 hours; they died in from three to five days. In young mice the disease follows a similar course. Guinea pigs can be infected by subcutaneous inoculation. Virus dropped onto the chorio-allantoic membrane of a developing chick embryo rapidly infects the entire embryo, which dies within a day. Brains of guinea pigs moribund with the Venezuela disease are especially rich in virus. Four that we have titrated have all been infectious for mice in a dilution of 10^{-7}. This indicates a virus concentration 10 to 100 times greater than that usually found in Eastern diseased brains. Several embryo-cultured virus preparations have had dilution end-points of 10^{-8}. They thus have contained about the same amount of virus as Western strain diseased embryos; Eastern strain embryos are ordinarily more infectious.

It has been shown[1] that formalinized virus vaccines will give solid immunity against corresponding forms of encephalomyelitis. We have made similar vaccines with Venezuela virus. All guinea pigs thus far vaccinated with them have successfully withstood the intracerebral injection of massive doses of Venezuelan virus.

Cross-protection tests have been made involving Venezuelan disease on the one hand and Western and Eastern encephalomyelitis on the other. Western strain vaccinated guinea pigs injected with Venezuelan virus have all succumbed with no evidence of protection. Eastern immune pigs diseased with Venezuelan virus have also all died, though in many instances a day or so later than unvaccinated controls. In a third experiment two groups of animals protected with the Venezuelan vaccine were given 10 to 100 m.l.d. of Eastern strain virus. They all died of encephalomyelitis, but those injected with the smaller dose outlived their controls.

These results demonstrate that our Venezuelan strain of encephalomyelitis is immunologically different from the familiar Eastern and Western forms of this disease. Though they are as yet insufficient to settle the question, they suggest that a remote relationship may exist between the Eastern and Venezuelan strains. No comparisons have been possible with the viruses of Borna's disease or of Russian encephalomyelitis. Work with the Venezuelan disease is being continued.

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[1] M. S. Shahan and L. T. Giltner, *Jour. Am. Vet. Med. Assoc.*, 84: 928, 1934; P. K. Olitsky and H. R. Cox, *Jour. Exp. Med.*, 63: 745, 1936; J. W. Beard, H. Finkelstein, W. C. Sealy and R. W. G. Wyckoff, SCIENCE, 87: 89 and 490, 1938; C. E. Beck and R. W. G. Wyckoff, SCIENCE, 88: 264, 1938; A. Eichhorn and R. W. G. Wyckoff, *Jour. Am. Vet. Med. Assoc.*, 46: 285, 1938.

THE PROTECTIVE EFFECT OF SULFANILAMIDE IN MICE AGAINST GONOCOCCAL "TOXIN"

SINCE sulfanilamide was first introduced for the treatment of gonococcal infections, we have been interested in the possibility that the favorable action of the drug might be concerned with the "toxin" of the gonococcus. Although the bactericidal effect of sulfanilamide *in vitro* has previously been demonstrated,[1,2] we have recently obtained an *in vitro* inactivation of gonococcal "toxin" with the compound.[3] Clinical data indicate that factors other than a direct effect of the drug on the gonococcus may contribute to its therapeutic efficacy. Thus, it is well known that certain patients recover with a minimal concentration of the drug in the tissues, while others fail to be cured when a high concentration is present. On the other hand, it has been frequently observed that the gonococcus is still present in infected areas after the symptoms have subsided subsequent to treatment with sulfanilamide. These facts point to an interaction of sulfanilamide with a gonococcal "toxin." Although some doubt has prevailed as to the existence of a substance which can rightly be termed a "toxin," our studies substantiate the findings of earlier investigators,[4,5] whose work indicates that a "toxin" is formed by the gonococcus.

By employing a technique similar to that described by Clark, Ferry and Steele[4] for the production of gonococcal "toxin," whole cultures, filtrates and supernates were prepared from several strains of the

[1] H. F. Wengatz, R. A. Boak and C. M. Carpenter, *Jour. of Bact.*, 35: 36, 1938.

[2] A. Cohn, *Am. Jour. Syph., Gonorr. and Ven. Diseases*, 22: 1, 1938.

[3] C. M. Carpenter, G. M. Barbour and P. L. Hawley, *Jour. of Bact.*, 36: 280, 1938.

[4] J. DeChristmas, *Ann. de l'Inst., Pasteur*, II: 609, 1897.

[5] L. T. Clark, N. S. Ferry and M. H. Steele, *Jour. Immunology*, 21: 233, 1931.

gonococcus which were fatal for mice in large doses. Because of the instability of these materials, the preparations were lyophilized by means of a Flosdorf-Mudd apparatus.[6] This procedure not only stabilized, but also concentrated the preparations, which were complex mixtures of metabolic products and autolysed cells. A regenerated lyophilized ascitic fluid broth culture of the gonococcus, containing no viable organisms, was employed in our studies. It is this type of preparation to which we give the name "toxin."

Although ascitic fluid broth cultures of several of our strains of the gonococcus killed mice, the results reported herewith concern only one particular strain, the "Le D." This strain was isolated during March, 1937, from the knee-joint of a patient with gonococcal arthritis.

After determining that the intraperitoneal injection of 0.2 cc of the regenerated lyophilized "toxin" killed mice (20 to 30 gm) consistently, a study was made of the relative toxicities and therapeutic values of various preparations of sulfanilamide. A 2 per cent. solution of the compound in 0.85 per cent. NaCl solution was found to be most satisfactory for our purposes. The sulfanilamide was administered intraperitoneally in two doses, one of 10 mg immediately after the injection of the "toxin" and a second of 20 mg 5 hours later.

After inoculation, the control mice usually died within 18 hours; a few lived longer than 24 hours. The coat became rough; the mice were listless and remained in a crouched position until death. Generally, diarrhoeae developed shortly after inoculation and the temperature became subnormal. The eyelids were often stuck together with a mucopurulent exudate.

The mice treated with sulfanilamide became cyanotic, ataxic or spastic and markedly opisthotonic. The reactions from the drug subsided in less than an hour, after which time the mice presented, to a lesser degree, some of the symptoms observed in the controls. When the drug became effective, the treated mice improved gradually, the majority recovering within 48 hours.

TABLE 1

THE THERAPEUTIC EFFECT OF SULFANILAMIDE IN MICE INOCULATED WITH GONOCOCCAL "TOXIN"

Group	No. of mice injected	Treated No.	Treated Died	Untreated No.	Untreated Died
1 ..	15	10	0	5	5
2 ..	15	10	0	5	5
3 ..	13	9	0	4	4
4 ..	16	10	0	6	6
5 ..	8	5	0	0	3
6 ..	60	50	4	10	10
Total .	127	94	4(4.3 per cent.)	33	33(100 per cent.)

Summary		Per cent. protected	Standard error
	Mice with sulfanilamide .	95.7	±2.1
	Mice without sulfanilamide	0	

Results obtained with intraperitoneal doses of 10 and 20 mg of sulfanilamide administered immediately and 5 hours, respectively, after the intraperitoneal injection of 0.2 cc of lyophilized and regenerated gonococcal "toxin" ("Le D" strain).

[6] E. W. Flosdorf and S. Mudd, *Jour. Immunology*, 29: 389, 1935.

The results obtained by averaging 6 tests are given in Table 1. Six groups of mice were used in this particular study, the number of mice per group varying from 8 to 60. The total number was 127, of which 33 were controls. All the controls died within 24 hours. Only 4, or 4.3 per cent., of 94 treated mice failed to be protected. Of these, 2 lived for 4 days after treatment.

In summary, gonococcal "toxin" (a term used to describe the regenerated lyophilized ascitic fluid broth culture of the gonococcus, containing no viable cells, used in the present studies), which killed mice following its intraperitoneal injection, was produced from several strains of *Neisseria gonorrhoeae*. In the present report the results with one strain only, the "Le D," are described.

Mice injected with lethal amounts of the gonococcal "toxin" were protected from death by the administration of adequate therapeutic doses of sulfanilamide.

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THE FEASIBILITY OF PRESERVING NEOPLASTIC CELLS IN THE FROZEN STATE[1]

STUDIES on the resistance of single-celled or small multicellular animals and plants to extreme cold are reviewed by Heilbrunn,[2] who points out that survival after freezing may be due to factors which inhibit ice crystal formation. Ice crystals injure the cell both mechanically and by withdrawing water from the protoplasm. It is generally believed that slow freezing is associated with the formation of large crystals and is more injurious than rapid freezing.

Experiments on the resistance of the more labile neoplastic cells of mammals to freezing have yielded different results in the hands of different investigators. Carcinoma cells have been kept alive by Ehrlich[3] for two years at −8° C. This temperature does not completely solidify the tissue. Ehrlich has also found that the growth of carcinoma cells is retained after exposure to −30° C. for 48 hours. Michaelis[4] has successfully transplanted Jensen's tumor after it had been exposed to liquid air for a half hour. His obser-

[1] These investigations have been supported by the International Cancer Research Foundation, the Lady Tata Memorial Trust and a Fund for the Study of Leukemia.

[2] L. V. Heilbrunn, "An Outline of General Physiology," Philadelphia and London, W. B. Saunders Company, 1937.

[3] P. Ehrlich, *Zeitschr. f. Krebsf.*, 5: 65, 1907.

[4] L. Michaelis, *Med. Klin.*, 5: 204, 1905.

vations have been confirmed by Moore and Walker[5] and Gaylord.[6] Little consideration has been given to the rate of freezing or thawing, and the tissues have not been kept in the frozen state for long periods.

We have observed recently[7] that slow freezing is less injurious to neoplastic cells than is rapid freezing, and cells that were destroyed by rapid freezing survived slow freezing. At the time these observations were made, the authors were not aware of the similar results obtained by Rahn[8] with rotifers, nematodes and tardigrades. Rahn has found that these animals, in the active state, survived slow cooling to −253° C. but were killed when frozen rapidly.

The rate of deterioration of neoplastic cells in the frozen state is very slow, and the results shown in Table I indicate that they can be stored for long periods at −70° C.

TABLE I

RESULTS OF INOCULATIONS OF FROZEN AND THAWED MOUSE NEOPLASMS

Cell	Length of time kept at −70° C.	Route of injection	No. of mice		Average incubation period	Average length of life after inoculation
			inoculated	+		
	(days)				(days)	(days)
Lymphoid leukemia (Strain Akf 5)	8	s.c.	6	6	12	28
	86	s.c.	2	2	13	16
	147	s.c.	4	4	13	17
	440	i.v.,s.c.	4	4	15	25
Myelocytic leukemia (Strain Ar 117)	20	s.c.	7	5	19	42
	99	s.c.	6	5	17	58
	281	i.v.,s.c.	6	6	9	56
	440	s.c.	2	2	18	
Chloroleukemia (Strain S1b 351)	6	i.v.	4	1	24	42
	447	i.v.,s.c.	5	0		
	13	i.v.	4	1	21	36
	94	i.v.	5	0		
	1	i.v.,s.c.	5	4	14	25
Monocytic leukemia (Strain S2)	2	s.c.	4	4	14	23
	52	s.c.	4	3	13	20
	337	i.v.,s.c.	3	2	10	20
	430	i.v.,s.c.	4	3	15	25
Sarcoma (Strain S.3172)	1	s.c.	4	4	13	56
	151	s.c.	4	4	13	61
	448	s.c.	4	4	13	70
Carcinoma (Strain Afb 601)	2	s.c.	4	4	14	63
	98	s.c.	4	4	17	75

Abbreviations used in the table: s.c. = subcutaneously; i.v. = intravenously.

Technic: The tissue to be frozen was removed immediately after the animals were killed and was placed in a Petri dish on a chilled ice plate. It was minced with scissors in the presence of a small amount of Tyrode's solution. The minced tissue was distributed in small test-tubes (9×75 mm), approximately 0.5 cc in each, and the tubes were sealed with a blast lamp. The sealed tubes were immersed in alcohol at 0° C. and small pieces of solid C_2 were dropped in the alcohol at such a rate that the temperature dropped from 0° C. to −70° C. during approximately one hour. The frozen tissue was stored under alcohol in a 12-gallon thermos bottle containing large pieces of solid CO_2. The tissues to be injected were thawed rapidly by shaking the tube in water at 37° C. This was found to be less injurious to the tissue than slow thawing.

Epithelium of chicken trachea was preserved in the frozen state in a similar manner. Many cilia were actively motile after 2, 16 and 327 days.

All strains of neoplasms tested could be preserved without difficulty except for the myeloid cells of a transmissible chloroleukemia (Strain S1b 351), but these, too, were found to resist freezing when large fragments of spleen, with no Tyrode's solution, were frozen.

The possibility that transmission by frozen cells is due to a virus present in the cells is very unlikely.[7] The results of an experiment suggested by W. A. Barnes are noteworthy in this connection. Cells irradiated while in the frozen state at −70° C. with 4000 r of x-ray were completely inactivated. This dose of x-ray does not injure viruses at room temperature, and it is not likely to injure them at −70° C.

Summary: All neoplastic cells so far tested could be preserved by freezing, and the virulence of those tested after a year at −70° C. had not altered.

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